中華民國天文學會 2020 年年會　　2020 ASROC Annual Meeting

Day 1 (September 3, Thursday) 第一天（9 月 3 日，星期四） **Venue/地點：ASIAA/中研院天文所**			
09:00 – 10:00	**Registration 註冊報到**		
10:00 – 10:15	**Opening remarks 大會開幕致詞** Chair: You-Hua Chu 朱有花 **Welcome remark by Shiang-Yu Wang (Acting Director of ASIAA)** **歡迎詞：王祥宇代理所長（中研院天文所）** （天文數學館國際會議廳/ ASMAB Auditorium）		
10:15 – 10:45	**Plenary talk (I) 大會講演(I)** Chair: You-Hua Chu 朱有花 ***Evolution of the Stellar Family Structure*** **Prof. Wen-Ping Chen 陳文屏 (NCU)**		
10:45 – 12:15	**Scientific oral session S1 科學論文宣讀 S1** Chair: Albert Kong 江國興 **High Energy/AGN**		
S1.1 **10:45 – 11:00**	Neutron Star Mergers as the Main Source of R-process: Natal Kicks and Inside-Out Evolution to The Rescue	Meng-Ru Wu	ASIP
S1.2 **11:00 – 11:10**	Dynamical Interactions between Globular Clusters and Intermediate-Mass Black Holes	Chia-Hsuan Cheng	NTHU
S1.3 **11:10 – 11:20**	On the jet structure of GRBs through X-ray light curve modeling	En-Tzu Lin	NTHU
S1.4 **11:20 – 11:30**	The Polarization Performance of the Compton Telescopes - The Compton Spectrometer and Imager (COSI) and the Compton Polarimeter (Compol)	Chien-Ying Yang	NTHU
S1.5 **11:30 – 11:40**	From cosmic ray accompanied outflows to quasi-thermal outflows	Bilal Ramzan	NCU
S1.6 **11:40 – 11:50**	Feasibility of Observing Gamma-Ray Polarization from Cygnus X-1 Using a CubeSat with GAGG scintillator	Jr-Yue Hsiang	NTHU
S1.7 **11:50 – 12:00**	High energy emission mechanism in blazar	Jane Yap	NTHU
S1.8 **12:00 – 12:15**	Characterising the contribution of star-forming galaxies to the extragalactic gamma-ray background	Ellis Owen	NTHU
12:15 – 13:30	**Group Photo 團體照** **Lunch break and poster session P1 午餐及壁報欣賞 P1** **Special Event: National Observatory Discussion** （天文數學館 101 教室/ASMAB RM101）		
13:30 – 14:00	**Plenary talk (II) 大會講演(II)** Chair: Sheng-Yuan Liu 呂聖元 ***Baby Stars' Magnetized Cradles*** **Prof. Shih-Ping Lai 賴詩萍 (NTHU)**		
14:00 – 15:35	**Scientific oral session S2 科學論文宣讀 S2** Chair: Lihwai Lin 林俐暉 **AGN/Galaxy**		

S2.1 **14:00 – 14:15**	Identifying AGN host galaxies with Deep Learning	Yu-Yen Chang	NCHU
S2.2 **14:15 – 14:25**	An Active Galactic Nucleus recognition model based on Deep Neural Network	Bo-Han Chen	NTHU
S2.3 **14:25 – 14:35**	Environmental Effects on AGN Activities via Extinction-free Mid-Infrared Census	Daryl Joe Santos	NTHU
S2.4 **14:35 – 14:45**	The Empirical Relation of the Quasar Structure Function from ATLAS Data	Ji-Jia Tang	ANU
S2.5 **14:45 – 14:55**	Mass Bias of Weak-lensing Shear-selected Galaxy Cluster Samples	Kai-Feng Chen	ASIAA
S2.6 **14:55 – 15:05**	Multiple Core Frequency of the Largest IFU Sample of Brightest Cluster Galaxies: implications on the merger rate	Yun-Hsin Hsu	ASIAA
S2.7 **15:05 – 15:20**	Revisiting the Color-Color Selection: Submillimeter and AGN Properties of NUV-r-J Selected Quiescent Galaxies	Yu-Hsuan Hwang	ASIAA
S2.8 **15:20 – 15:35**	CO Observations on Galactic Outflows in Starbrust Galaxy NGC3628	An-Li Tsai	NCU
15:35 – 16:00	**Coffee break and poster session P2　茶敘及壁報欣賞 P2**		
16:00 – 18:05	**Scientific oral session S3　科學論文宣讀 S3** Chair: Wei-Ling Tseng 曾瑋玲 **Star Formation/Solar System**		
S3.1 **16:00 – 16:10**	The JCMT/SCUBA-2 Transient Survey for the detection of accretion variability and transient phenomena	Bhavana Lalchana	NCU
S3.2 **16:10 – 16:20**	Diagnosing Triggered Star Formation in the Galactic HII region Sh 142	Tanvi Sharma	NCU
S3.3 **16:20 – 16:30**	Accretion Flows in a Young Class 0 Protostar: Lupus 3-MMS	Travis Thieme	NTHU
S3.4 **16:30 – 16:40**	Observational Constraint on Eccentricity of Protoplanetary Disk MWC758 with ALMA	I-Hsuan Kuo	ASIAA
S3.5 **16:40 – 16:55**	Looking into the high-mass star-forming core G335.579-0.272 MM1 with ALMA	Femando Olguin Choupay	NTHU
S3.6 **16:55 – 17:05**	25 AU Angular Resolution Observations of HH 211 with ALMA: Jet Properties and Shock Structures in SiO, CO, and SO	Kai-Syun Jhan	ASIAA
S3.7 **17:05 – 17:15**	Interplay between Molecular Clouds and Young Objects in the Rho Ophiuchus	Aashish Gupta	NCU
S3.8 **17:15 – 17:25**	Deuterium Chemodynamics of Massive Pre-Stellar Cores	Chia-Jung Hsu	Chalmers University
S3.9 **17:25 – 17:35**	Evolution of grain size distribution in Milky Way-like galaxies in IllustrisTNG	Yu-Hsiu Huang	ASIAA /NTHU
S3.10 **17:35 – 17:45**	ALMA Survey of Orion Planck Galactic Cold Clumps (ALMASOP): Detection of New Hot Corinos with ACA	Shih-Ying Hsu	ASIAA/NTU
S3.11 **17:45 – 17:55**	Hunting Trans-Neptunian Objects with the Hyper Suprime-Cam Deep Layers	Marielle Eduardo	ASIAA/NCU
S3.12 **17:55 – 18:05**	The light curve simulator and analysis pipeline for the TAOS II	Chung-Kai Huang	ASIAA/NCU
18:30 – 21:30	**Conference banquet** **晚宴**		

Day 2 (September 4, Friday)	**第二天（9 月 4 日，星期五）** **Venue/地點：ASIAA/中研院天文所**		
09:00 – 09:30	**Plenary talk (III)　大會講演 (III)** Chair: Yi-Nan Chin 秦一男 ***A Reflection on my Ring of Fire Experience*** **Prof. Albert Kong 江國興 (NTHU)** （天文數學館國際會議廳/ ASMAB Auditorium）		
09:30 – 11:00	**Scientific oral session S4** **科學論文宣讀 S4**	**Education & Public Outreach session E1** **天文教育及業餘天文活動報告 E1**	
09:30 – 11:00	**Scientific oral session S4　科學論文宣讀 S4** Chair: Shiang-Yu Wang 王祥宇 **Solar System/Disks**		
S4.1 **09:30 – 09:45**	OSSOS. XVIII. Constraining Migration Models with the 2:1 Resonance Using the Outer Solar System Origins Survey	Ying-Tung Chen	ASIAA
S4.2 **09:45 – 10:00**	Revealing the Unknowns of Exoplanets through Transit Signals	Ing-Guey Jiang	NTHU
S4.3 **10:00 – 10:15**	Upper mass stability limit of (co-orbital) horseshoe planets	A.Paula Granados Contreras	ASIAA
S4.4 **10:15 – 10:30**	Polarimetric and Radiative Transfer Modelling of HD 172555's Debris Disc	Jonathan Marshall	ASIAA
S4.5 **10:30 – 10:45**	Missing water in disks around low-mass stars	Daniel Harsono	ASIAA
S4.6 **10:45 – 11:00**	Possible Time Correlation Between Jet Ejection and Mass Accretion for RW Aur A	Hiro Takami	ASIAA
09:30 – 10:45	**Education & Public Outreach session E1** **天文教育及業餘天文活動報告 E1** Chair: Mei-Yin Chou 周美吟 （天文數學館 1108 教室/ASMAB RM1108）		
E1.1 **09:30 – 09:45**	ASIAA EPO 與 "AEIOU"	Lauren Huang	ASIAA
E1.2 **09:45 – 10:00**	特殊天象觀察融入社區教育與終身學習	Jim Hung	士林、文山社區大學
E1.3 **10:00 – 10:15**	流星撞擊月閃光觀測系統建立與教學應用	Jim Lee	TAM
E1.4 **10:15 – 10:30**	建立館校合作學習模式–行動天文館成果初探	Chi-Feng Lin	TAM
E1.5 **10:30 – 10:45**	中小學太陽相關課程之天文輔助教具簡介	Kuei-Lan Chang	TAM
11:00 – 11:20	**Coffee break and poster session P3　茶敘及壁報欣賞 P3**		
11:20 – 12:30	**ASROC Awards Presentation Ceremony　頒獎典禮暨會員大會** Chair: You-Hua Chu 朱有花 （天文數學館國際會議廳/ ASMAB Auditorium）		
11:20 – 11:30	Typhoon Lee asteroid commission ceremony 李太楓小行星發佈典禮 Chair: Chorng-Yuan Hwang 黃崇源		

11:30 – 11:35	Presentation of the 7th *Heaven Talk Award* 頒發天文學會第七屆「譚天獎」		
11:35 – 12:30	General Assembly, best poster awards & presentations. Annular solar eclipse photo contest awards & comments 會員大會、頒發最佳壁報論文獎及得獎論文口頭報告 日環食攝影比賽頒獎與講評		
12:30 – 13:30	**Lunch break and poster session P4　午餐及壁報欣賞 P4** **Special Event: Efficient Image Visualization with CARTA** （天文數學館 101 教室/ASMAB RM101）		
13:30 – 15:15	**Scientific oral session S5 科學論文宣讀 S5** Chair: Shin-Ping Lai 賴詩萍 **Star Formation/ISM**		
S5.1 **13:30 – 13:45**	Revealing Ionization Conditions of the Young Star Sz 102 with Spatially Resolved [Ne III] Microjets	Chun-Fan Liu	ASIAA
S5.2 **13:45 – 14:00**	ALMA Survey of Orion Planck Galactic Cold Clumps (ALMASOP): Evolution from the prestellar core to protostars	Somnath Dutta	ASIAA
S5.3 **14:00 – 14:15**	The ALMA View of Complex Chemistry toward Embedded Protostars	Yao-Lun Yang	U. of Virginia
S5.4 **14:15 – 14:30**	Constraints of the formation and abundances of methyl carbamate, a glycine isomer, in hot corinos	Dipen Sahu	ASIAA
S5.5 **14:30 – 14:45**	Formation of the Hub-Filament System G33: Interplay between Gravity, Velocity, and Magnetic Field	Jia-Wei Wang	ASIAA
S5.6 **14:45 – 15:00**	Probing Magnetic Fields in the Circumgalactic Medium	Ting-Wen Lan	UC Santa Cruz
S5.7 **15:00 – 15:15**	The drag instability in 1D isothermal C-shock in typical star-forming clouds	Pin-Gao Gu	ASIAA
15:15 – 15:30	**Coffee break and poster session P5　壁報欣賞 P5**		
15:30 – 17:15	**Scientific oral session S6　科學論文宣讀 S6** Chair: Yi-Jehng Kuan 管一政 **The Best for the Last**		
S6.1 **15:30 – 15:45**	Exploring the size distribution of dust grains in the interstellar medium using infrared and X-ray spectroscopy	Sascha Zeegers	ASIAA
S6.2 **15:45 – 16:00**	Disentangling Dust Properties, Grain Alignment and Magnetic Field Structure with Multi-Wavelength Submillimeter Polarization	Lapo Fanciullo	ASIAA
S6.3 **16:00 – 16:15**	Evolution from Spherical AGB Wind to Multipolar Outflow in Pre-planetary Nebula IRAS 17150−3224	Po-Sheng Huang	ASIAA
S6.4 **16:15 – 16:30**	The Radial Acceleration Relation in CLASH Galaxy Clusters	Yong Tian	NCU
S6.5 **16:30 – 16:45**	HO Puppis: A Sub-Luminous Hot Star with IW-And Type Light Curve	Chien-De Lee	NCU
S6.6 **16:45 – 17:00**	Commissioning the Yuan-Tseh Lee Array	Kai-Yang Lin	ASIAA
S6.7 **17:00 – 17:15**	Design of a newly opened course "Astroinformatics" at National Central University	Daisuke Kinoshita	NCU
17:15 ~17:45	**Announcing new council members 公布新任理監事** **Best oral award 頒發最佳口頭報告獎**		

	Lottery 抽獎 Chair: You-Hua Chu 朱有花
17:45 ~	**Departure　賦歸**

Oral Presentation

Speakers are not allowed to use your own computer for presentation. All presenters are required to transfer your presentation files to the computer in the conference room before the session start.

Plenary I **Evolution of the Stellar Family Structure**
Wen-Ping Chen 陳文屏 (NCU)

Plenary II **Baby Stars' Magnetized Cradles**
Shih-Ping Lai 賴詩萍 (NTHU)

Plenary III **A Reflection on my Ring of Fire Experience**
Albert Kong 江國興 (NTHU)

S1.1 **Neutron Star Mergers as the Main Source of R-process: Natal Kicks And Inside-Out Evolution to The Rescue**
Projjwal Banerjee (Indian Institute of Technology Palakkad); Meng-Ru Wu (Institute of Physics, Academia Sinica); Zhen Yuan (Shanghai Astronomical Observatory)

S1.2 **Dynamical Interactions between Globular Clusters and Intermediate-Mass Black Holes**
Chia-Hsuan Cheng (Department of Physics, NTHU); Ing-Guey Jiang (Institute of Astronomy, NTHU; Department of Physics, NTHU; Center for Informatics and Computation in Astronomy, NTHU)

S1.3 **On the jet structure of GRBs through X-ray light curve modeling**
En-Tzu Lin(NTHU), Fergus Hayes(University of Glasgow), Gavin P. Lamb(University of Leicester), Albert K. H. Kong(NTHU), Ik Siong Heng(University of Glasgow)

S1.4 **The Polarization Performance of the Compton Telescopes - The Compton Spectrometer and Imager(COSI) and the Compton Polarimeter(Compol)**
Chien-Ying Yang (NTHU); Hsiang-Kuang Chang (NTHU); COSI collaborations; Compol collaborations

S1.5 **From cosmic ray accompanied outflows to quasi-thermal outflows**
Bilal Ramzan (Institute of Astronomy, National Central University, Zhongli District, Taoyuan City, Taiwan (R.O.C.))D.O. Chernyshov (I.E. Tamm Theoretical Physics Division of P.N. Lebedev Institute of Physics, Leninskii pr. 53, 119991 Moscow, Russia)Chung-Ming Ko (Department of Physics and Center of Complex System, National Central University, Zhongli District., Taoyuan City, Taiwan (R.O.C.))

S1.6 **Feasibility of Observing Gamma-Ray Polarization from Cygnus X-1 Using a CubeSat with GAGG scintillator**
Jr-Yue Hsiang (NTHU)Hsiang-Kuang Chang (NTHU); Chien-Ying Yang (NTHU);Yi-Chi Chang(NTHU);Che-Yen Chu(NTHU);Jeng-Lun Chiu(NTHU);Chih-Hsun Lin(Institute of Physics, Academia Sinica, Taipei, Taiwan);Philippe Laurent(CEA/DRF/IRFU/DAp, Saclay, France);Jerome Rodriguez(CEA/DRF/IRFU/DAp, Saclay, France); Yun-Hsin Chung(NTHU);Tzu-Hsiang Su(NTHU)

S1.7 **High energy emission mechanism in blazar**
Y. X. Jane Yap (NTHU), K. Wu (UCL-MSSL), A.K.H Kong (NTHU)

S1.8 **Characterising the contribution of star-forming galaxies to the extragalactic gamma-ray background**
Ellis Owen (NTHU)

S2.1 **Identifying AGN host galaxies with Deep Learning**
Yu-Yen Chang (NCHU/ASIAA), Bau-Ching Hsieh (ASIAA), Wei-Hao Wang (ASIAA), Yen-Ting Lin (ASIAA), Chen-Fatt Lim (NTU/ASIAA), Yoshiki Toba (Kyoto U/ASIAA/Ehime U) et al.

S2.2 **An Active Galactic Nucleus recognition model based on Deep Neural Network**
Bo Han Chen(Department of Physics, National Tsing Hua University);Tomotsugu Goto(Institute of Astronomy, National Tsing Hua University);Seong Jin Kim(Institute of Astronomy, National Tsing Hua University);Ting Wen Wang(Institute of Astronomy, National Tsing Hua University)

S2.3 **Environmental Effects on AGN Activities via Extinction-free Mid-Infrared Census**
Daryl Joe D. Santos, Tomotsugu Goto, Seong Jin Kim, Ting-Wen Wang, Simon C.-C. Ho, Tetsuya Hashimoto, Ting-Chi Huang, Alvina Y. L. On, Ting-Yi Lu, Tiger Y.-Y. Hsiao

S2.4 **The Empirical Relation of the Quasar Structure Function from ATLAS Data**
Ji-Jia Tang (Australian National University); Christian Wolf (Australian National University); John Tonry (University of Hawaii)

S2.5 **Mass Bias of Weak-lensing Shear-selected Galaxy Cluster Samples**
Kai-Feng Chen (NTU/ASIAA); Masamune Oguri (UTokyo/iPMU); Yen-Ting Lin (ASIAA); Satoshi Miyazaki (NAOJ/Sokendai)

S2.6 **Multiple Core Frequency of the Largest IFU Sample of Brightest Cluster Galaxies: implications on the merger rate**
Yun-Hsin Hsu(ASIAA/NTHU); Yen-Ting Lin(ASIAA); Gabriel Torrealba(ASIAA); Dylan Nelson(MPA); Song Huang(Princeton)

S2.7 **Revisiting the Color-Color Selection: Submillimeter and AGN Properties of NUV-r-J Selected Quiescent Galaxies**
Yu-Hsuan Hwang (ASIAA); Wei-Hao Wang (ASIAA); Yu-Yen Chang (NCHU); Chen-Fatt Lim (ASIAA); Chian-Chou Chen (ASIAA); and Zhen-Kai Gao (NCU, ASIAA)

S2.8 **CO Observations on Galactic Outflows in Starbrust Galaxy NGC3628**
Tsai, Anli (NCU); Rizzo, J. Ricardo (CSIC/INTA); Hwang, Chorng-Yuan (NCU); Chapillon Edwige (IRAM)

S3.1 **The JCMT/SCUBA-2 Transient Survey for the detection of accretion variability and transient phenomena**
Bhavana Lalchand (National Central University, Taiwan); Wen-Ping Chen (National Central University, Taiwan); Steve Mairs (East Asian Observatory, Hilo, USA); Gregory J. Herczeg (Kavli Institute for Astronomy and Astrophysics, Peking University, People's Republic of China); Doug Johnstone (NRC Herzberg Astronomy and Astrophysics, & Department of Physics and Astronomy, University of Victoria, Canada)

S3.2 **Diagnosing Triggered Star Formation in the Galactic HII region Sh 142**
Tanvi Sharma(300 Zhongda Road, Graduate Institute of Astronomy, National Central University, Zhongli 32001 Taoyuan, Taiwan); Wen-Ping Chen(300 Zhongda Road, Graduate Institute of Astronomy, National Central University, Zhongli 32001 Taoyuan, Taiwan); Neelam Panwar (Aryabhatta Research Institute of Observational Sciences~(ARIES), Manora Peak, Nainital 263 002, India); Yan Sun (Purple Mountain Observatory, Nanjing 210033, China); Yu Gao (Purple Mountain Observatory, Nanjing 210033, China)

S3.3 **Accretion Flows in a Young Class 0 Protostar: Lupus 3-MMS**
Travis Thieme (NTHU), Shih-Ping Lai (NTHU), Sheng-Jun Lin (NTHU), Pou-Ieng Cheong (NTHU), Ka Ho Lam (UVa), Zhi-Yun Li (UVa), Bo Zhao (MPE)

S3.4 **Observational Constraint on Eccentricity of Protoplanetary Disk MWC758 with ALMA**
Kuo, I-Hsuan (ASIAA/NTU); Yen, Hsi-Wei (ASIAA); Gu, Pin-Gao (ASIAA)

S3.5 **Looking into the high-mass star-forming core G335.579-0.272 MM1 with ALMA**
Fernando Olguin (NTHU), Patricio Sanhueza (NAOJ), Vivien Chen (NTHU), Andres Guzman (NAOJ), Xing Lu (NAOJ)

S3.6 **25 AU Angular Resolution Observations of HH 211 with ALMA : Jet Properties and Shock Structures in SiO, CO, and SO**
Kai-Syun Jhan (ASIAA); Chin-Fei Lee (ASIAA)

S3.7 **Interplay between Molecular Clouds and Young Objects in the Rho Ophiuchus**
Aashish Gupta (National Central University); Wen-Ping Chen (National Central University)

S3.8 **Deuterium Chemodynamics of Massive Pre-Stellar Cores**
Chia-Jung Hsu(Chalmers University of Technology); Jonathan Tan(Chalmers University of Technology); Matthew D. Goodson(University of North Carolina at Chapel Hill); Paola Caselli(Max-Planck-Institute for Extraterrestrial Physics); Bastian Körtgen(Universität Hamburg); Yu Cheng(University of Virginia)

S3.9 **Evolution of grain size distribution in Milky Way-like galaxies in IllustrisTNG**
Yu-Hsiu Huang (ASIAA/NTU); Hiroyuki Hirashita (ASIAA); Yen-Ting Lin (ASIAA); DylanNelson (MPA); Andrew Cooper (NTHU); Yun-Hsin Hsu (ASIAA/NTHU)

S3.10 **ALMA Survey of Orion Planck Galactic Cold Clumps (ALMASOP): Detection of New Hot Corinos with ACA**
Shih-Ying Hsu (NTU); Sheng-Yuan Liu (ASIAA); Tie Liu (SHAO); the ALMASOP collaboration

S3.11 **Hunting Trans-Neptunian Objects with the Hyper Suprime-Cam Deep Layers**
Marielle R. Eduardo (NCU, ASIAA), Ying-Tung Chen (ASIAA), Shiang-Yu Wang (ASIAA), Wen-Ping Chen (NCU)

S3.12 **The light curve simulator and analysis pipeline for the TAOS II**
Chung-Kai Huang (NCU/ASIAA); Matthew Lehner (ASIAA/UPenn/CfA); Á. Paula Granados C. (ASIAA); Zhi-Wei Zhang (ASIAA); Wen-Ping Chen (NCU); Shiang-Yu Wang (ASISS)

S4.1 **OSSOS. XVIII. Constraining Migration Models with the 2:1 Resonance Using the Outer Solar System Origins Survey**
Ying-Tung Chen (ASIAA); Brett Gladman (UBC); Kathryn Volk (University of Arizona); Ruth Murray-Clay (University of California, Santa Cruz); Matthew J. Lehner (ASIAA, University of Pennsylvania, Harvard-Smithsonian Center for Astrophysics); J. J. Kavelaars (HIA, University of Victoria); Shiang-Yu Wang (ASIAA); Hsing-Wen Lin (University of Michigan, NCU); Patryk Sofia Lykawka (Kindai University); Mike Alexandersen (ASIAA); Michele T. Bannister (Queen's University Belfast); Samantha M. Lawler (HIA); Rebekah I. Dawson (Pennsylvania State University); Sarah Greenstreet(B612 Asteroid Institute, University of Washington); Stephen D. J. Gwyn (HIA); Jean-Marc Petit (Institut UTINAM)

S4.2 **Revealing the Unknowns of Exoplanets through Transit Signals**
Ing-Guey Jiang (National Tsing Hua University)

S4.3 **Upper mass stability limit of (co-orbital) horseshoe planets**
A. Paula Granados C.; Aaron C. Boley

S4.4 **Polarimetric and Radiative Transfer Modelling of HD 172555's Debris Disc**
Jonathan Marshall (Academia Sinica, Institute of Astronomy and Astrophysics, 11F Astronomy-Mathematics Building, NTU/AS campus, No. 1, Section 4, Roosevelt Rd., Taipei 10617, Taiwan); Daniel V. Cotton (University of Southern Queensland, Centre for Astrophysics, Toowoomba, QLD 4350, Australia); Peter Scicluna (European Southern Observatory, Alonso de Cordova 3107, Santiago RM, Chile); Jeremy Bailey (School of Physics, University of New South Wales, Sydney, NSW 2052, Australia); Lucyna Kedziora-Chudczer (University of Southern Queensland, Centre for Astrophysics, Toowoomba, QLD 4350, Australia); Kimberly Bott (Department of Earth and Planetary Science, University of California, Riverside, CA, 92521, USA)

S4.5 **Missing water in disks around low-mass stars**
Daniel Harsono (ASIAA)

S4.6 **Possible Time Correlation Between Jet Ejection and Mass Accretion for RW Aur A**
Hiro Takami (ASIAA), Tracy L. Beck (STScI, USA) et al.

S5.1 **Revealing Ionization Conditions of the Young Star Sz 102 with Spatially Resolved [Ne III] Microjets**
Chun-Fan Liu (ASIAA), Hsien Shang (ASIAA), Gregory J. Herczeg (KIAA/PKU), Frederick M. Walter (Stony Brook Univ.)

S5.2 **ALMA Survey of Orion Planck Galactic Cold Clumps (ALMASOP): Evolution from the prestellar core to protostars**
Somnath Dutta (ASIAA, Taiwan); Chin-Fei Lee (ASIAA, Taiwan); Tie Liu (SHAO, China); Naomi Hirano(ASIAA, Taiwan); Sheng-Yuan Liu(ASIAA, Taiwan); ALMASOP team

S5.3 **The ALMA View of Complex Chemistry toward Embedded Protostars**
Yao-Lun Yang (University of Virginia)

S5.4 **Constraints of the formation and abundances of methyl carbamate, a glycine isomer, in hot corinos**
Dipen sahu (ASIAA); Sheng-Yuan Liu (ASIAA); Ankan Das (ICSP); Prasanta Garai (ICSP); and Valentine Wakelam (LAB)

S5.5 **Formation of the Hub-Filament System G33: Interplay between Gravity, Velocity, and Magnetic Field**
Jia-Wei Wang, Patrick M. Koch, Hauyu Baobab Liu, Shih-Ping Lai

S5.6 **Probing Magnetic Fields in the Circumgalactic Medium**
TIng-Wen Lan (UCSC)

S5.7 **The drag instability in 1D isothermal C-shock in typical star-forming clouds**
Pin-Gao Gu (ASIAA); Che-Yu Chen (Univ. of Virginia)

S6.1 **Exploring the size distribution of dust grains in the interstellar medium using infrared and X-ray spectroscopy**
Sascha Zeegers (ASIAA); Ciska Kemper (ESO/ASIAA); Stefan Bromley (Universitat de Barcelona); Joan Mariñoso Guiu (Universitat de Barcelona); Elisa Costantini (SRON); Daniele Rogantini (SRON); Irene Abril Cabezas (Universidad Complutense de Madrid); Cor de Vries (SRON); Ioanna Psaradaki (SRON); Missagh Mehdipour (SRON)

S6.2 **Disentangling Dust Properties, Grain Alignment And Magnetic Field Structure With Multi-Wavelength Submillimeter Polarization**
Lapo Fanciullo (ASIAA)

S6.3 **Evolution from Spherical AGB Wind to Multipolar Outflow in Pre-planetary Nebula IRAS 17150−3224**
Po-Sheng Huang (ASIAA/NTU); Chin-Fei Lee (ASIAA/NTU); Raghvendra Sahai (JPL)

S6.4 **The Radial Acceleration Relation in CLASH Galaxy Clusters**
Yong Tian(Institute of Astronomy, National Central University, Taoyuan City, Taiwan (ROC)); Keiichi Umetsu(Academia Sinica Institute of Astronomy and Astrophysics (ASIAA), No. 1, Section 4, Roosevelt Road, Taipei 10617, Taiwan); Chung-Ming Ko(Institute of Astronomy, National Central University, Taoyuan City, Taiwan (ROC); Department of Physics and Center of Complex Systems, National Central University, Taoyuan City, Taiwan (ROC)); Megan Donahue(Physics and Astronomy Department, Michigan State University, East Lansing, MI 48824, USA); I-Non Chiu(Academia Sinica Institute of Astronomy and Astrophysics (ASIAA), No. 1, Section 4, Roosevelt Road, Taipei 10617, Taiwan)

S6.5 **HO Puppis: A Sub-Luminous Hot Star with IW-And Type Light Curve**
Chien-De Lee (Graduate Institute of Astronomy, National Central University); Jia-Yu Ou (Graduate Institute of Astronomy, National Central University); Po-Chieh Yu (Graduate Institute of Astronomy, National Central University); Chow-Choong Ngeow (Graduate Institute of Astronomy, National Central University); Po-Chieh Huang (Graduate Institute of Astronomy, National Central University); Wing-Huen Ip (Graduate Institute of Astronomy, National Central University); Franz-Josef Hambsch (AAVSO); Hyun-il Sung (Korea Astronomy and Space Science Institute (KASI), Bohyunsan Optical Astronomy Observatory (BOAO)); Jan van Roestel (Division of Physics, Mathematics, and Astronomy, California Institute of Technology); ZTF buliders

S6.6 **Commissioning the Yuan-Tseh Lee Array**
Kai-Yang Lin (ASIAA), YTLA Team

S6.7 **Design of a newly opened course "Astroinformatics" at National Central University**
Daisuke Kinoshita (NCU)

E1.1 **ASIAA EPO 與 "AEIOU"**
Lauren Huang

E1.2 **特殊天象觀察融入社區教育與終身學習**
洪景川(台北市天文協會，台北市士林與文山社區大學)

E1.3 **流星撞擊月閃光觀測系統建立與教學應用**
李瑾

E1.4 **建立館校合作學習模式-行動天文館成果初探**
林琦峯

E1.5 **中小學太陽相關課程之天文輔助教具簡介**
張桂蘭/臺北市立天文科學教育館

Posters List

The poster boards can accommodate posters of up to 100 cm in WIDTH and 140 cm in HEIGHT. Posters in either "portrait" or "landscape" format smaller than this dimension can be fitted on the board. An A0 size poster (120 cm by 84 cm), for example, can be displayed in portrait format.

A. Solar System/Exoplanets

1 **Multi-wavelength transit photometry of exoplanets for star spot study**
Tzu-Heng Chang(Graduate institute of astronomy, National Center University); Wing-Huen Ip(Graduate institute of astronomy, National Center University); Yao Hsiao(Graduate institute of astronomy, National Center University); Chia-Lung Lin(Graduate institute of astronomy, National Center University)

2 **Search for the Molecular Exosphere on Enceladus**
Chia-Cheng Chiang (蔣佳呈)(Department of Earth Sciences, National Taiwan Normal University), Yi-Jehng Kuan (管一政)(Department of Earth Sciences, National Taiwan Normal University), Yo-Ling Chuang (莊幼玲)(Department of Earth Sciences, National Taiwan Normal University)Chien-Hsun, Li (李建勳)(Graduate Institute of Applied Physics, National Taiwan University), Hsien-Ju, Tsai(蔡顯如)(Department of Earth Sciences, National Taiwan Normal University), Guan-Ting, Su (蘇冠庭)(Department of Physics, National Taiwan Normal University)

3 **First result of bacteria growth in primordial H2 atmosphere at NCU**
Yao Hsiao (IANCU); Chia-Lung Lin (IANCU); Che-Wei Lu (NCULS); Shih-Ching Chen (NCULS); Wing-Huen Ip (IANCU)

4 **Saving low-mass planets from orbital migration in dusty disks**
He-Feng Hsieh (NTHU, ASIAA); Min-Kai Lin (ASIAA)

5 **Quasi-Periodic Pulsation in Radio Emission of Solar Flare**
Po Chih Hsu (Department of Atmospheric Science, NCU); Ya Hui Yang (Department of Space Science and Engineering, NCU)

6 **Characterization of the space weather effects of some habitable exoplanets**
Li-Ching Huang, Wing-Huen Ip, Chia-Lung Lin, Yao Hsiao and Fiona Chang

7 **以科學定年法探討行星之構造運動**
Ming-Hung Kao (Taipei Astronomical Museum)

8 **A comparative study of the orbital evolution of Atira and Vatira asteroids**
Hsuan-Ting Lai (National Central University); Wing-Huen Ip (National Central University)

9 **Possible Near-Nucleus Environment of Main Belt Comet 133P/Elst-Pizarro**
Ying Liao (Origin Space/NCU); Ian Lin Lai (University of Bern); Liang Liang Yu (Macau University of Science and Technology); Wing Huen Ip (NCU)

10 **Lulin observations of the Barbarian asteroids**
Kang-Shian Pan(NCU), Win-Huen Ip(NCU), Alberto Cellino(INAF)

11 **Generation of superthermal hydrogen beams in the vicinity of the Saturnian rings**
Hua-Shan Shi (Institute of Space Science, National Central University, Taiwan); Wing-Huen Ip (Institute of Space Science, National Central University, Taiwan; Institute of Astronomy, National Central University, Taiwan); Meng-Tse Yang (Institute of Space Science, National Central University, Taiwan)

12 **Study of D68 Dust Material Flow Affected by Electrodynamics**
Meng-Tse Yang (Graduate Institute of Space Science, National Central University, Taoyuan City, Taiwan); Wing-Huen Ip (Graduate Institute of Space Science, National Central University, Taoyuan City, Taiwan; Graduate Institute of Astronomy, National Central University, Taoyuan City, Taiwan)

13 **A Cometary Atlas of Kepler Observations**
Ting-Shuo Yeh (IANCU) and Wing-Huen Ip (IANCU)

B. Stars/Star Clusters

14 **Spectroscopic Line-Profile Variations of a Planet-Hosting A-Type Star WASP-33**
Napaporn A-thano (Institute of Astronomy, National Tsing Hua University, Hsinchu 30013, Taiwan); Ing-Guey Jiang (Institute of Astronomy, National Tsing Hua University, Hsinchu 30013, Taiwan); David Mkrtichian (National Astronomical Research Institute of Thailand, 260 Moo 4, T. Donkaew, A. Maerim, Chiangmai 50180, Thailand); Stevanus K. Nugroho (School of Mathematics and Physics, Queen’s University Belfast, University Road, Belfast BT7 1NN, UK); Hajime Kawahara (Department of Earth and Planetary Science, The University of Tokyo, Tokyo 113-0033, Japan ; Research Center for the Early Universe, School of Science, The University of Tokyo, Tokyo 113–0033, Japan)

15 **搜尋疏散星團 NGC 6834 中的短週期變星**
張桂蘭

16 **Modeling the spatial distribution of neutron star merger remnants in the Milky Way**
Heng-Hao Chen (National Tsing-Hua University); Meng-Ru Wu (Institute of Physics, Academia Sinica)

17 **3D simulations of superluminous supernovae**
Ke-Jung Chen

18 **Impact of deleptonization on core-collapse supernova multimessenger signals**
Ting-Yuan Chen(Department of Physics, National Tsing Hua University, Hsinchu, Taiwan) ;Kuo-Chuan Pan(Institute of Astronomy, National Tsing Hua University, Hsinchu, Taiwan ; Department of Physics, National Tsing Hua University, Hsinchu, Taiwan)

19 **Possible Bridge: Radiation Hydrodynamic with Variable Eddington Tensor in Stellar Wind and Shock Breakout**
Wun-Yi Chen (NTU, ASIAA);Ken Chen (ASIAA)

20 **Searching for Young Stellar Objects through SEDs by Machine Learning Methods**
Yi-Lung Chiu (NTHU), Chi-Ting Ho (NTHU), Daw-Wei Wang (NTHU), Shih-Ping Lai (NTHU)

21 **Searching for Lensing Candidates**
Hsiao-Cheng Chou (NCU); Chorng-Yuan Hwang (NCU)

22 **High Frequency Radio Observations of Two Magnetars, 1E1547.0−5408 and PSR J1622−4950**
Che-Yen Chu (Institute of Astronomy, National Tsing Hua University); C.-Y. Ng (Department of Physics, The University of Hong Kong); Albert K. H. Kong (Institute of Astronomy, National Tsing Hua University); Hsiang-Kuang Chang (Institute of Astronomy, National Tsing Hua University)

23 **ALMA Observations toward the S-shaped Outflow and the Envelope around NGC1333 IRAS4A2**
Chen-Yu Chuang (NTU/ASIAA); Yusuke Aso (KASI); Naomi Hirano (ASIAA); Shingo Hirano (Kyushu University); Masahiro N. Machida(Kyushu University)

24 **A Comprehensive, Multi-Wavelength Survey on the Nebula Structures Around Wolf-Rayet Stars in the Large Magellanic Cloud**
Clara Hung (Summit K2 High School / ASIAA); Po-Sheng Ou (ASIAA / NTU); You-Hua Chu (ASIAA); Robert A. Gruendl (UIUC); Chuan-Jui Li (ASIAA)

25 **Forbidden Line Emission from Balmer-dominated Supernova Remnants**
Chuan-Jui Li 李傳睿 (ASIAA), You-Hua Chu 朱有花 (ASIAA)

26 **An analysis of flares of Wolf 359 with EDEN and K2 observations**
Chia-Lung Lin (Graduate Institute of Astronomy, National Central University, Taoyuan 32001, Taiwan);Wen-Ping Chen (Graduate Institute of Astronomy, National Central University, Taoyuan 32001, Taiwan);Wing-Huen Ip (Graduate Institute of Astronomy, National Central University, Taoyuan 32001, Taiwan)

27 **Time-Resolved Optical Flares of the nearby M Dwarf Wolf 359**
Han-Tang Lin, Wen-Ping Chen (Graduate Institute of Astronomy, National Central University); Jinzhong Liu (Xinjing Astronomical Observatory)

28 **Impact of nuclear heating on the mixing of kilonova ejecta**
Li-Ting Ma(Institute of Astronomy, National Tsing-Hua University), Meng-Ru Wu(Institute of Physics, Academia Sinica), Kuo-Chuan Pan(Department of Physics and Institute of Astronomy, National Tsing-Hua University),

29 **Machine learning & time series analysis on Mira variables: from OGLE to ZTF.**
JiaYu Ou(Graduate Institute of Astronomy, National Central University);Chow-Choong Ngeow(Graduate Institute of Astronomy, National Central University)

30 **Candidates of X-ray-Faint Balmer-Dominated Supernova Remnant in M33**
Po-Sheng Ou (ASIAA/NTU); You-Hua Chu (ASIAA); Chuan-Jui Li (ASIAA)

31 **Critical Metallicity of Stellar Mass Loss and Red Supergiant Formation**
Po-Sheng Ou (ASIAA/NTU); Ke-Jung Chen (ASIAA); You-Hua Chu (ASIAA)

32 **Monitoring the Variability of 95 GHz Methanol Masers with YTLA**
Po-Sheng Ou (ASIAA/NTU); Geoffrey Bower (ASIAA); Kai-Yang Lin (ASIAA)

33 **Creating a legacy survey of variable stars in the crowded galactic plane.**
Atharva Patil (NCU, Taiwan); Prof. Chow-Choong Ngeow (NCU, Taiwan)

34 **Hiding Surviving Companions in Type Ia Supernova Remnants**
Shiau-Jie Rau (Department of Physics and Institute of Astronomy, National Tsing-Hua University, Hsinchu 30013, Taiwan; Center for Informatics and Computation in Astronomy, National Tsing Hua University, Hsinchu 30013, Taiwan); Kuo-Chuan Pan (Department of Physics and Institute of Astronomy, National Tsing-Hua University, Hsinchu 30013, Taiwan; Center for Informatics and Computation in Astronomy, National Tsing Hua University, Hsinchu 30013, Taiwan; National Center for Theoretical Sciences, National Tsing Hua University, Hsinchu 30013, Taiwan)

35 **Generating Kilonova Light Curves Using Recurrent Neural Network/ Autoencoder to Investigate the Properties of a Compact Binary Merging System**
Surojit Saha(a)*, Albert Kong(a), Ik Siong Heng(b), Martin Hendry(b), Laurence Datrier(b), Michael Williams(b), Daniel Williams(b), Nicola De Lillo(b), Fergus Hayes(b)(a)Institute of Astronomy, National Tsing Hua University Hsinchu, R.O.C(b)Institute for Gravitational Research, School of Physics and Astronomy, University of Glasgow, Scotland

C. Galaxy/Extragalactic

36 **Spatially resolving stellar population properties of galaxies across cosmic time with piXedfit**
Abdurrouf (ASIAA); Yen-Ting Lin (ASIAA); Po-Feng Wu (NAOJ); Masayuki Akiyama (Tohoku University)

37 **Testing the existence of linear black hole mass − τ relation for LLAGN**
Boyan Chen (NTHU), Geoffrey C. Bower (ASIAA), Jason Dexter (Colorado), Sera Markoff (Amsterdam), Anthony Ridenour (Keck) and Huei-Ru Vivien Chen (NTHU)

38 **Magnetohydrodynamics Simulations of the First Galaxy Formation**
Huai-Hsuan Chiu (ASIAA/NTU), Ke-Jung Chen (ASIAA)

39 **SCUBA-2 Ultra Deep Imaging EAO Survey (STUDIES): Confusion-limited Submillimeter Galaxy Number Counts at 450 μm**
Zhen-Kai Gao (ASIAA/NCU); Chen-Fatt Lim (ASIAA/NTU); Wei-Hao Wang (ASIAA); Chian-Chou Chen (ASIAA)

40 **No redshift evolution of non-repeating fast radio-burst rates**
Tetsuya Hashimoto (NTHU); Tomotsugu Goto (NTHU); Alvina Y. L. On (UCL); Ting-Yi Lu (NTHU); Daryl Joe D. Santos (NTHU); Simon C.-C. Ho (NTHU); Seong Jin Kim (NTHU); Ting-Wen Wang (NTHU); Tiger Y.-Y. Hsiao (NTHU)

41 **Spectral energy distributions of dust and PAHs based on the evolution of grain size distribution in galaxies**
Hiroyuki Hirashita (ASIAA); Weining Deng (NTU); Maria S. Murga (Russian Academy of Sciences)

42 **Unveiling quasar host galaxies and their Lyα emission at z~6 by SHELLQs**
Simon C.-C. Ho (NTHU); Tomotsugu Goto (NTHU); Tetsuya Hashimoto (NTHU)

43 **Dark matter distributions in the central regions of nearby spiral galaxies**
Cheng-Lin Liao (Department of Physics, National Central University); Chorng-Yuan Hwang (Graduate Institute of Astronomy, National Central University)

44 **Color gradients in nearby galaxies with the Legacy Survey**
Li-Wen Liao (NTHU); Andrew Cooper (NTHU)

45 **Waltz of the Galaxies: Galaxy mergers with different mass**
Chi-hong lin (IANCU, ASIAA); Ke-Jung Chen (ASIAA); Chorng-Yuan Hwang (IANCU)

46 **Investigating environmental effects on dark-matter-deficient galaxies in the Sloan Digital Sky Survey**
Chih-Teng Ling (NTHU); Tomotsugu Goto (NTHU); Tetsuya Hashimato (NTHU)

47 **Size-Mass Relations of Galaxies from Sloan Digital Sky Survey**
Shemile Poblete (Institute of Astronomy, National Central University, Taoyuan City, Taiwan (R.O.C.)); Yong Tian (Institute of Astronomy, National Central University, Taoyuan City, Taiwan (R.O.C.)); Chung-Ming Ko (Institute of Astronomy, National Central University, Taoyuan City, Taiwan (R.O.C.) and Department of Physics and Center of Complex Systems, National Central University, Taoyuan City,Taiwan (R.O.C.))

48 **Radial Acceleration Relation of Elliptical Galaxies in Sloan Digital Sky Survey DR15**
Arcy Layne Sace (Institute of Astronomy, National Central University, Taoyuan City, Taiwan (R.O.C.)) ; Chung-Ming Ko (Department of Physics and Center of Complex Systems, National Central University, Taoyuan City, Taiwan (R.O.C.))

49 **ALMaQUEST survey: What cause the velocity discrepancy between CO and Hα rotation?**
Yung-Chau Su(NTU/ASIAA); Li-Hwai Lin(ASIAA);Hsi-An Pan(MPIA);Bau-Ching Hsieh(ASIAA)

50 **Gravitational Field Flux Mechanism for Structural-Dynamical Relations of Systems near Galactic Scale**
Te-Chun Wang (Li-Chih High School)

51 **ALMA Observations of FRB121102**
Keng-Wei, Wu(National Tsing Hua University, Dept. of Physics);Goto Tomotsugu(National Tsing Hua University,Institute of Astronomy);Hashinoto Tetsuya(National Tsing Hua University,Institute of Astronomy);Seong Jin Kim(National Tsing Hua University,Institute of Astronomy);Jimmy C.-T. ,Ling(National Tsing Hua University, Dept. of Physics);Daryl Joe D. Santos(National Tsing Hua University,Institute of Astronomy);Simon C.-C., Ho(National Tsing Hua University,Institute of Astronomy);Tina T.-W., Wang(National Tsing Hua University,Institute of Astronomy);Nicole T.-Y.,Lu(National Tsing Hua University,Institute of Astronomy);

52 **Distinguishing galaxies and young stellar objects in multi-dimensional magnitude space**
Kuan-Hsien Wu (NTHU), Meng-Zhe Yang, Shih-Ping Lai(NTHU)

53 **probing dark matter distributions of dwarf disk galaxies using SDSS MaNGA and 2MASS**
Weijing Wu (Graduate Institute of Astronomy, National Central University, Zhongli District, Taoyuan, Taiwan); Chorng-Yuan Hwang (Graduate Institute of Astronomy, National Central University, Zhongli District, Taoyuan, Taiwan)

D. Star Formation

54 **Magnetic Fields surrounding Filamentary Molecular Clouds**
Hsin-Yu Chen(ASIAA); Mehrnoosh Tahani (Dominion Radio Astrophysical Observatory); Ken Chen(ASIAA)

55 **Analysis on the relation between the magnetic field and filamentary structure**
Wei-An Chen (National Cheng Kung University); Ya-Wen Tang (ASIAA); Jia-Wei Wang (ASIAA)

56 **Diffusion Drived by Internal Gravity Wave in the First Hydrostatic Core**
Chang-Ming Cheng (National Taiwan Normal University)

57 **N2H+ Line Observation by Yuan-Tseh Lee Array**
Wen-Tse Chien (ASIAA); Geoffrey Bower (ASIAA); Kai-Yang Lin (ASIAA)

58 **The JCMT BISTRO Survey: Magnetic Fields Associated with a Network of Filaments in Massive Star-forming Region Onsala 2**
Hao-Yuan Duan (NTHU); Shih-Ping Lai (NTHU)

59 **Investigating effects of magnetic fields on gas kinematics in protostellar sources**
Aashish Gupta (National Central University, Academia Sinica); Hsi-Wei Yen (Academia Sinica)

60 **ALMA Survey of Orion PGCCs (ALMASOP): Discovery of the prestellar core on the verge of star formation**
Naomi Hirano (ASIAA); Sheng-Yuan Liu (ASIAA); Tie Liu (SHAO); Chin-Fei Lee (ASIAA); Sienny Shang (ASIAA); Dipen Sahu (ASIAA); Somnath Dutta (ASIAA); Anthony Moraghan (ASIAA); Kai-Syun Jhan (NTU/ASIAA); Shi-Ying Hsu (NTU/ASIAA); Kee-Tae Kim (KASI); Ken'ichi Tatematsu (NRO); Gwanjeong Kim (NRO)

61 **Chronology of Episodic Accretion in Protostars - an ALMA survey of the CO and H2O snow lines**
Tien-Hao Hsieh (ASIAA), Nadia Murillo (RIKEN), Arnaud Belloche (MPIfR), Naomi Hirano (ASIAA), Catherine Walsh (University of Leeds), Ewine F. van Dishoeck (Leiden), Jes K. Jørgensen (Niels Bohr Institute), Shih-Ping Lai (NTHU)

62 **Characterization of filaments in the infrared dark cloud SDC13**
Han-Tsung Lee(Department of Physics, National Central University) , Ya-Wen Tang(ASIAA) , Jia-Wei Wang(ASIAA)

63 **Collapse and Stability Analysis of Sheet-like Structures in the Molecular Cloud**
Meng-Hsien Shen (NTNU); Yueh-Ning Lee (NTNU)

64 **Protoplanetary disk assemblage and evolution revisited with effects of non-ideal magneto-hydrodynamics**
Yueh-Ning Lee (NTNU); Sébastien Charnoz (IPGP); Patrick Hennebelle (CEA Saclay)

65 **The Thickness of Molecular Cloud**
Ting-Xuan Li (NTNU); Yueh-Ning Lee (NTNU)

66 **The Scale of Self-gravity of Molecular Clouds**
Hung-Lin Liao(Department of Earth Science, NTNU); Yueh-Ning Lee(Department of Earth Science, NTNU)

67 **Magnetically self-regulated formation of discs**
Yu-hsuan Liu (National Taiwan Normal University)Yueh-Ning Lee (National Taiwan Normal University)

68 **Population III star formation within turbulent primordial gas**
Ching-Yao Tang(NTU); Ke-Jung Chen(ASIAA)

69 **On the fragmentation in dense cores**
Ya-Wen Tang (ASIAA)

70 **The kinematics of the infalling envelope around HH111: Does magnetic braking steal angular momentum in a protostellar system?**
Yi-Shan Tsai (ASIAA/NTU); Chin-Fei Lee (ASIAA)

71 **Small- and large-scale dynamos as the first astrophysics case for GPU API Astaroth**
Miikka Väisälä (ASIAA); Johannes Pekkilä (Aalto University); Maarit Käpylä (Aalto University, Max Planck Institute for Solar System Research, Nordita); Matthias Rheinhardt (Aalto University); Hsien Shang (ASIAA); Ruben Krasnopolsky (ASIAA)

72 **Dust trapping and feedback in the protoplanetary disk around HD142527**
Hsi-Wei Yen (ASIAA); Pin-Gao Gu (ASIAA)

E. Facility Program

73 **Identification of AKARI sources by deep HSC Survey - New Band-Merged Catalog on the NEPW field**
Seong-Jin KIM (NTHU); Nagisa OI (Tokyo University of Science, Japan); Tomo Goto (NTHU); Hiroyuki Ikeda (NAOJ); Simon Ho (NTHU); Hyunjin Shim (KNU, Korea); Yoshiki Toba (Kyoto University, Japan); Ho Seong Hwang (KASI); Tetsuya Hashimoto (NTHU); the NEPW collaboration, et al.

74 **A Robotic Telescope System for Cosmic Transients**
Kwan-Lok Li (NCKU); Albert K. H. Kong (NTHU)

75 **Efficient image visualization with CARTA - live demos**
Kuo-Song Wang (ACDC, ASIAA) and the CARTA development team

F. Cosmology

76 **Dark energy constrained from fast radio bursts without redshift**
Tiger Yu Yang Hsiao (National Tsing Hua University); Tomotsugu Goto (National Tsing Hua University), Tetsuya Hashimoto (National Tsing Hua University)

77 **Geometry effects on dust attenuation curves with different grain sources at high redshift**
Yen-Hsing Lin (NTHU/ASIAA); Hiroyuki Hirashita (ASIAA)

78 **Cosmic reionization investigated with Subaru High-z Exploration of Low-Luminosity Quasars**
Ting-Yi Lu (NTHU), Tomotsugu Goto (NTHU), Tetsuya Hashimoto (NTHU), Daryl Joe D. Santos (NTHU), Seong Jin Kim (NTHU), Alvina Y. L. On (UCL), Yoshiki Matsuoka (Ehime U.), Toru Nagao (Ehime U.), and the SHELLQs team

79 **Diffuse Lyman α emission in IllustrisTNG**
Sung-Han Tsai (NTU/ASIAA); Ke-Jung Chen (ASIAA); Aaron Smith (MIT); Yi-Kuan Chiang (MIT)

G. High Energy

80 **Centaurus A Observation with the Compton Spectrometer and Imager**
Y.-C. Chang (Institute of Astronomy, National Tsing Hua University, Taiwan) C. Sleator (Space Sciences Laboratory, University of California, Berkeley, CA 94720, USA) A. Zoglauer (Space Sciences Laboratory, University of California, Berkeley, CA 94720, USA)C.-Y. Yang (Institute of Astronomy, National Tsing Hua University, Taiwan) C.-Y. Chu (Institute of Astronomy, National Tsing Hua University, Taiwan) J. A. Tomsick (Space Sciences Laboratory, University of California, Berkeley, CA 94720, USA)) Hsiang-Kuang Chang (Institute of Astronomy, National Tsing Hua University, Taiwan)S. E. Boggs (Center for Astrophysics and Space Sciences, University of California, San Diego, CA 92093-0424)C.-H. Lin (Institute of Physics, Academia Sinica, Taipei 11529, Taiwan)P. Jean (RAP Toulouse, 9 avenue du Colonel Roche, Toulouse, France)for the COSI Collaboration

81 **Performance of Observing Gamma-Ray Polarization using CubeSat**
Yun-Hsin Chung (NTHU), Tzu-Hsiang Su (NTHU), Chien-Ying Yang (NTHU), Yi-Chi Chang (NTHU), Che-Yen Chu (NTHU), Jr-Yue Hsiang (NTHU), Jeng-Lun Chiu (NSPO), Chic-Hsun Lin (AS). Philippe Laurent (CEA/DRF/IRFU/DAp, Saclay, France), Jerome Rodriguez (CEA/DRF/IRFU/DAp, Saclay, France), and Hsiang-Kuang Chang (NTHU)

82 **A timing study of the 2018/19 outbursts of MAXI J1820+070**
Holger Stiele (NTHU), Albert Kong (NTHU)

83 **Performance of Observing Gamma-Ray Polarization using CubeSat**
Tzu-Hsiang Su (NTHU), Yun-Hsin Chung (NTHU), Chien-Ying Yang (NTHU), Yi-Chi Chang (NTHU), Che-Yen Chu (NTHU), Jr-Yue Hsiang (NTHU), Jeng-Lun Chiu (NSPO), Chic-Hsun Lin (AS). Philippe Laurent (CEA/DRF/IRFU/DAp, Saclay, France), Jerome Rodriguez (CEA/DRF/IRFU/DAp, Saclay, France), and Hsiang-Kuang Chang (NTHU)

H. Outreach and Education

84 **探討民眾選擇觀賞劇場關鍵因子**
趙瑞青

85 **A Jigsaw Approach to Engage Students in Learning Classical Problems of Astronomy**
Albert Kong (Institute of Astronomy, National Tsing Hua University)

Invited I

Evolution of the Stellar Family Structure

Wen-Ping Chen 陳文屏 (NCU)

Stars are formed in groups out of dense molecular clouds. Most these stellar aggregates are dispersed as long as placental gas and dust is cleared, and only a minor fraction remain gravitationally bound and seen today as star clusters. I will report on the efforts by my group to diagnose the cluster dynamical evolution, from initial morphology at birth, to mass segregation via internal relaxation, to stellar evaporation that eventually leads to cluster disintegration, with then-members becoming the Galactic field stars. I will outline a few outstanding issues in the study of star clusters in general.

Invited II

Baby Stars' Magnetized Cradles

Shih-Ping Lai 賴詩萍 (NTHU)

"Whether the magnetic field plays a critical role in star formation" is a hotly debated topic persisting for several decades. The problem remains unsolved mostly due to lack of data with sufficient sensitivity. In the past few years, thanks to the new telescope (ALMA) and the new instrument (Pol-2 on JCMT), the quality and quantity of magnetic field data improved drastically. With these impressive data, can we finally settle the debate?

Invited III

A Reflection on my Ring of Fire Experience

Albert Kong 江國興 (NTHU)

In this talk, I reflect on my past experience of observing solar eclipses around the globe. Since 1999, I have observed 8 total solar eclipses and 3 annular solar eclipses. Apart from admiring the beauty of mother nature, I enjoy every solar eclipse event as a regional fiesta. I will also discuss solar eclipse as an outreach activity.

S1.1

Neutron Star Mergers as the Main Source of R-process: Natal Kicks And Inside-Out Evolution to The Rescue

Projjwal Banerjee (Indian Institute of Technology Palakkad);
Meng-Ru Wu (Institute of Physics, Academia Sinica);
Zhen Yuan (Shanghai Astronomical Observatory)

Binary neutron star mergers (BNSMs) is currently the most promising source of r-process thanks to the detection of GW170817. The estimated occurring frequency and the amount of mass ejected per merger indicate that BNSMs by itself can account for all the r-process enrichment in the Galaxy. However, the decreasing trend of [Eu/Fe] vs [Fe/H] of disk stars for [Fe/H] > -1 in the solar neighborhood is inconsistent with the flat trend expected from BNSMs with a standard delay time distribution (DTD) inversely proportional to time. This has led to the suggestion that either additional sources or modification to the DTD of BNSMs is required to match the observations. We investigate the effects of natal kicks received during the birth of neutron star binaries on the chemical evolution of r-process element Eu in the Milky Way by combining the results from the galactic dynamics code Galpy with a one-zone Galactic chemical evolution model Omega. We show that when key inputs from simulations of the inside-out disk evolution are combined with natal kicks, BNSMs can naturally reproduce the observed decreasing trend of [Eu/Fe] with [Fe/H] in the solar neighborhood without the need for modification to the DTD or additional r-process sources.

S1.2

Dynamical Interactions between Globular Clusters and Intermediate-Mass Black Holes

Chia-Hsuan Cheng (Department of Physics, NTHU);
Ing-Guey Jiang (Institute of Astronomy, NTHU; Department of Physics, NTHU;
Center for Informatics and Computation in Astronomy, NTHU)

Globular clusters are supposed to be the possible places that intermediate-mass black holes (IMBHs) may reside. The existence of the IMBHs may influence the properties of the clusters. Direct n-body simulations are employed to model the equilibrium states of globular clusters with IMBHs. We study the dynamical interactions between the central IMBH and the globular cluster. These dynamical signals could be valuable hints for the existence of IMBHs and thus lead to future techniques of IMBH detections.

S1.3

On the jet structure of GRBs through X-ray light curve modeling

En-Tzu Lin(NTHU), Fergus Hayes(University of Glasgow), Gavin P. Lamb(University of Leicester), Albert K. H. Kong(NTHU), Ik Siong Heng(University of Glasgow)

Mergers of binary neutron stars have been long considered as progenitors of short gamma-ray bursts (GRBs). This idea is confirmed by the detection of the gravitational wave event GW170817 associated with the short GRB 170817A observed by the Fermi gamma-ray telescope at around 2s post-merger (Goldstein et al. 2017). The interaction between the relativistic jet launched by the binary neutron star (BNS) merger and the surrounding medium can produce an after shine across the electromagnetic spectrum. For the case of GRB170817A, a structured jet seen off-axis can explain its afterglow light curve. With the expected increasing number of detections of BNS events in the future, observing GRB afterglow light curves as well as adopting the constraints from gravitational wave observations should help us resolve the structure of these jets. In this work, we performed an analysis with different structured jet models on simulated GRB X-ray light curves for model comparison. The goal of this project is to perform a statistical study to examine how future multi-messenger observations can resolve the intrinsic structure of GRB jets.

S1.4

The Polarization Performance of the Compton Telescopes - The Compton Spectrometer and Imager(COSI) and the Compton Polarimeter(Compol)

Chien-Ying Yang (NTHU); Hsiang-Kuang Chang (NTHU); COSI collaborations; Compol collaborations

Polarization measurements offer a unique method to determine the emission mechanisms and source geometries (e.g. magnetic field, accretion disk, and jet). Determining the polarization characteristics will provide crucial clues about the extreme environments in different astrophysical sources such as pulsars, AGNs, Galactic BHs, and Gamma-ray bursts(GRBs).\\ Gamma-ray polarization can be determined by Compton scattering. In this work, we use Monte Carlo simulations with a Geant4-based MEGAlib package to study the polarimetric performance of two Compton telescopes: the Compton Spectrometer and Imager (COSI) and Compton Polarimeter (Compol).\\ COSI is a compact Compton telescope which is inherently sensitive to gamma-ray polarization in the energy range of 0.2–2.0 MeV. A long duration gamma-ray burst, GRB 160530A, was detected by COSI during its 2016 COSI's balloon flight. In order to determine COSI's polarization response and to identify systematic deviations from an ideal sinusoidal modulation, the polarization performance of COSI was validated in the laboratory prior to the 2016. We took the measurements used to validate COSI's polarimetric performance. Based on these results, COSI has a high probability to determine the polarization of GRBs. \\ Compol is the instrument to observe gamma-ray polarization from Cygnus X-1 using a small Compton polarimeter on board a 3U CubeSat. Silicon detectors and cerium bromide scintillators were employed in the instrument models that we discuss in this study. We found that, with a 10 Ms on- axis, zenith-direction observation in a low-inclination, low-altitude, Earth-orbit radiation background environment, the minimum detectable polarization degree can be down to about 10$\%$ in 160–250 keV, 20$\%$ in 250–400 keV, and 65$\%$ in 400–2000 keV. A 3U CubeSat dedicated to observing Cygnus X-1 can therefore yield useful information on the polarization state of gamma-ray emissions from the brightest persistent X-ray black hole binary in the sky.\\

S1.5

From cosmic ray accompanied outflows to quasi-thermal outflows

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In the galactic environment thermal plasma, cosmic rays and magnetic field are roughly in equipartition of energy. We are interested in the dynamical role played by cosmic rays on outflows launched from the galactic disk. Our model is a four-fluid system which includes thermal plasma, cosmic rays and two opposite propagating self-excited Alfvèn waves. We seek steady state solutions of the system in flux-tube formulation. There are two categories of physically allowable solutions depending on the boundary conditions: cosmic ray accompanied outflows and quasi-thermal outflows. In the former one, cosmic ray is coupled to plasma all the way to large distances. In the later one, waves die out and cosmic ray is decoupled from the plasma and the outflow behaves like a pure thermal wind at large distances. To extend the model, we add wave damping mechanisms, such as nonlinear Landau damping. As expected, more complicated flow profiles become possible.

S1.6

Feasibility of Observing Gamma-Ray Polarization from Cygnus X-1 Using a CubeSat with GAGG scintillator

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Yun-Hsin Chung(NTHU);Tzu-Hsiang Su(NTHU)

Compton polarimeter(Compol), one of Compton telescope onboard a 3U Cubesat, works on gamma-ray polarization. In previous work(Yang et al. 2017), we took cerium bromide(CeBr3) as scintillators and reported a feasibility study on gamma-ray polarization for CygnusX-1. In this study, we replace CeBr3 with new material, Gd2A12Ga3012(GAGG) as the scintillators. There mainly come to two reasons: 1. Density of GAGG (6g/cm^3) is roughly 1.2 times larger than CeBr3(5.1g/cm^3), which enlarges the number of interactions of photon hits. 2. GAGG doesn't have the characteristic of being highly deliquescent but CeBr3 has. The results show that GAGG is more proper to be scintillators than CeBr3 for the use of polarization. First, it enhances the Compton efficiency of Compol due to a lot more detection of Compton events than the old version. Furthermore, it shows lower Minimum detection Polarization(MDP) to about 10% in 160-250 keV, 14% in 250-400 keV, and 35% in 400-2000 keV. In other words, this revision leads to better performance of polarization-sensitive detection.

S1.7

High energy emission mechanism in blazar

Y. X. Jane Yap (NTHU), K. Wu (UCL-MSSL), A.K.H Kong (NTHU)

This talk will focus on the high-energy emission mechanism of blazar, in which both the leptonic and hadronic model will be discussed. Traditionally, the one-zone leptonic synchrotron-self-Compton (SSC) is used to explain the high energy emission of blazar. On the other hand, the hadronic process receives less attention due to the complication in simulating the energy dependence of the cross section. The increased number of blazar spectrums poses a question about the origin of the high-energy emission since both models are able to reproduce most of the observations. We will discuss the radiation processes and their signatures in each model, for instance, synchrotron and SSC in the leptonic, and in the hadronic, proton-synchrotron, photo-pion process with different radiation fields, as well as gamma-ray induced pair cascades.

S1.8

Characterising the contribution of star-forming galaxies to the extragalactic gamma-ray background

Ellis Owen (NTHU)

Star-forming galaxies would presumably be environments rich in energetic cosmic rays due to the presence of massive stars and their remnants. Stellar remnants can supply seed particles and generate the shocks (via supernova explosions and other violent events) needed to accelerate the seeds to very high energies. These can interact to deposit energy into their environment, or to drive gamma-ray emission. In this talk, I will outline how the gamma-ray emission from these galaxies contributes to the extragalactic gamma-ray background, and discuss how the signatures that would emerge in the background power spectrum could be used to probe the redshift evolution of star-forming galaxy populations. I will also outline the prospects and limitations for observing these signatures with current and future facilities.

S2.1

Identifying AGN host galaxies with Deep Learning

Yu-Yen Chang (NCHU/ASIAA), Bau-Ching Hsieh (ASIAA), Wei-Hao Wang (ASIAA), Yen-Ting Lin (ASIAA), Chen-Fatt Lim (NTU/ASIAA), Yoshiki Toba (Kyoto U/ASIAA/Ehime U) et al.

We use machine learning techniques to investigate active galaxies, including X-ray selected AGNs (XAGNs), infrared selected AGNs (IRAGNs), and radio selected AGNs (RAGNs). Using known physical parameters in the Cosmic Evolution Survey (COSMOS) field, we are able to have well-established training samples in the ultra-deep regions of Hyper Suprime-Cam (HSC) survey. We use Python packages (XGBoost and Keras) to identify AGNs and show their performance (e.g., accuracy, precision, recall, F1-score, and AUROC). Our results indicate that the performance is high for bright XAGN and IRAGN host galaxies. HSC (optical) information with Wide-field Infrared Survey Explorer (WISE) band-1 and WISE band-2 (near-infrared) information perform well to identify AGN hosts. For both type-1 (broad-band) XAGNs and type-1 (unobscured) IRAGNs, the performance is very good by using optical to infrared information. These results can apply to the five-band data from the wide regions of the HSC survey, and future all-sky surveys.

S2.2

An Active Galactic Nucleus recognition model based on Deep Neural Network

Bo Han Chen(Department of Physics, National Tsing Hua University);
Tomotsugu Goto(Institute of Astronomy, National Tsing Hua University);
Seong Jin Kim(Institute of Astronomy, National Tsing Hua University);
Ting Wen Wang(Institute of Astronomy, National Tsing Hua University)

For the purpose of understanding cosmic accretion history of supermassive blackholes(SMBHs), a reliable way on recognizing active galactic nucleus(AGNs) from star-forming galaxies(SFGs) plays an important role. However, AGNs are usually obscured in UV and soft X-ray observations, and are also hard to be distinguished in mid-infrared(MIR) because SFGs have strong polycyclic aromatic hydrocarbon emission in MIR too. Thus, a reliable solutionon recognizing AGNs still remains unsolved. In this work, we provide an novel AGN recognition method based on Deep Neural Network,which significantly improve not only recovering rate on AGNs but also accuracy on classifying AGNs and SFGs. The Deep Neural Network takes 44 band magnitudes and errors as input, and gives the AGN/SFG classification result as output. In conclusion, the recognition accuracy is around 80.29% - 85.15%, with AGN recovering rate is around 85.83% - 88.04%.

S2.3

Environmental Effects on AGN Activities via Extinction-free Mid-Infrared Census

Daryl Joe D. Santos, Tomotsugu Goto, Seong Jin Kim, Ting-Wen Wang, Simon C.-C. Ho, Tetsuya Hashimoto, Ting-Chi Huang, Alvina Y. L. On, Ting-Yi Lu, Tiger Y.-Y. Hsiao

This study focused on unveiling the relationship between star formation/active galactic nucleus (SF/AGN) activity and environment of galaxies with mid-infrared (MIR) and far-infrared (FIR) detections in the AKARI North Ecliptic Pole Wide (NEPW) field in the redshift range $0 < z < 1.5$. The AKARI satellite, compared to other infrared (IR) telescopes (e.g., WISE and Spitzer), has the unique continuous 9-band filter coverage that provides more detailed photometry, thus allowing us to better characterize features that appear in the MIR. We constrained the properties of the selected galaxies using CIGALE, a spectral energy distribution (SED) fitting code. We also defined several parameters to describe the galactic environments of our sample: local galaxy density, clustercentric distance, and cluster-field galaxy classification. The AGN contribution fraction (ratio between the AGN luminosity and total IR luminosity) and the AGN number fraction (ratio of the number of AGNs over the total number of galaxies) were used as probes of AGN activity in this study. The specific star formation rates of the sample galaxies were also investigated. Both definitions of AGN activity showed consistent trends: AGN and star-formation activities decrease with denser environments only for ultra-luminous infrared galaxies (ULIRGs). This suggests that the environmental effect on quenching galactic activities is more effective in ULIRGs than less luminous galaxies. We present our current progress and possible physical explanations for our results.

S2.4

The Empirical Relation of the Quasar Structure Function from ATLAS Data

Ji-Jia Tang (Australian National University); Christian Wolf (Australian National University); John Tonry (University of Hawaii)

We aim at studying the accretion disk of active galactic nuclei (AGN) through quasar variability. We obtain ∼1200 quasars' light curves of two filters, o- and c-bands, from Asteroid Terrestrial-impact Last Alert System (ATLAS) survey. The observing time span is about four years with a total of ∼900 thousands and ∼250 thousands of data points for o- and c-bands, respectively. We use the structure function (SF) to analyze the quasar variability and discover an empirical relation between the SF, the bolometric luminosity (Lbol), the rest-frame wavelength (λrest), and the time difference (Δt). This relation will reveal the temperature profile of the accretion disk, and allow us to examine predictions from various accretion disk models using quasar SFs.

S2.5

Mass Bias of Weak-lensing Shear-selected Galaxy Cluster Samples

Kai-Feng Chen (NTU/ASIAA); Masamune Oguri (UTokyo/iPMU);
Yen-Ting Lin (ASIAA); Satoshi Miyazaki (NAOJ/Sokendai)

In this talk, we will present a detailed estimate of the Eddington bias on weak-lensing mass measurements of shear-selected galaxy cluster samples. Large samples of shear-selected clusters available in future surveys will provide an additional candidate to probe cluster cosmology and study cluster astrophysics with the benefit of a direct mass--observable relation. To make use of these samples, it is crucial to characterize any statistical bias and dispersion associate with the cluster mass measurements. The noisy nature of weak lensing measurements makes the Eddington bias the dominant systematic error in these mass estimates. By carefully taking the Eddington bias into account, we will demonstrate that our results can not only recover the underlying mass function for shear-selected cluster samples but also explained the anomalous X-ray properties previously observed in these samples.

S2.6

Multiple Core Frequency of the Largest IFU Sample of Brightest Cluster Galaxies: implications on the merger rate

Yun-Hsin Hsu(ASIAA/NTHU); Yen-Ting Lin(ASIAA); Gabriel Torrealba(ASIAA);
Dylan Nelson(MPA); Song Huang(Princeton)

Numerical simulations of ΛCDM suggest that central galaxies in massive dark matter halos, also known as the brightest cluster galaxies (BCGs), have undergone many merging events at redshift $z < 1$. Observationally verifying such a prediction is not only key in validating the ΛCDM structure formation paradigm, but also central to our understanding of the formation of the most massive galaxies in the universe. This work aims to look for BCGs with multiple cores (indicative of a merger in progress), and the ultimate goal is to constrain merger rates associated with these massive galaxies, as a function of cluster mass. Our BCG sample is extracted from the MaNGA survey, which provides spatially resolved velocity information for each of our BCGs, and allows us to robustly distinguish real associations of the cores with the main body of the BCG from chance projections. Taking advantage of MaNGA, we present the measurement of the frequency of BCGs with multiple cores of the largest IFU sample of BCGs. Moreover, this frequency of multiple cores can be combined with the merger timescale to derive the merger rate of BCGs. The merger time scale is derived from the state-of-the-art cosmological hydrodynamical simulations, 300 Mpc box of illustrisTNG simulation. We trace the merging events of BCGs in the simulation, and the time it appears as multiple-core that satisfies our observational criteria. Here we present the techniques we developed and show some preliminary results of the merger rate.

S2.7

Revisiting the Color-Color Selection: Submillimeter and AGN Properties of NUV-r-J Selected Quiescent Galaxies

Yu-Hsuan Hwang (ASIAA); Wei-Hao Wang (ASIAA); Yu-Yen Chang (NCHU); Chen-Fatt Lim (ASIAA); Chian-Chou Chen (ASIAA); and Zhen-Kai Gao (NCU, ASIAA)

The rapid quenching of massive quiescent galaxies (QGs) in the early universe is an important topic in galaxy evolution. We would like to revisit the color-color selection of QGs which is widely applied in QG studies. It is important to examine the robustness of the selection method since the degeneracy of old stars and dust absorption may cause dusty star-forming galaxies (SFGs) contaminating the color-selected QGs. This issue may affect the subsequent analysis and have consequences on our studies of the quenching mechanism. In this study, we selected 17811 QGs using the NUV-r-J diagram out to redshift around 3 from the high-quality multi-wavelength COSMOS2015 catalog. We examined their quiescence using JCMT SCUBA-2 450 and 850μm images from the S2COSMOS and STUDIES Large Programs, which provide the deepest submillimeter view of QGs covering the whole COSMOS field. We used auxiliary data including Spitzer MIPS 24μm, VLA 3GHz, and ALMA AS2COSMOS and A3COSMOS catalogs. The high resolution of auxiliary data and the large sample size of ALMA sources allows us to identify bright submillimeter galaxies among our selected QGs. We examined their spatial correlation and found a clustering signal on a scale of 7". By stacking the deep SCUBA-2 images, we found a population of 24μm or 3GHz detected (excluding radio AGNs) galaxies distributed out to redshift around 2 which is likely to be contamination of faint dusty SFGs. The results suggest a ∼10% contamination rate in the commonly used NUV-r-J selection, and therefore QG studies that employ similar selections should be made with strong caution. In addition, we found a strong correlation between QGs and radio AGNs in our sample, which may suggest a connection between the quenching mechanism and radio-mode AGN feedback.

S2.8

CO Observations on Galactic Outflows in Starbrust Galaxy NGC3628

Tsai, Anli (NCU); Rizzo, J. Ricardo (CSIC/INTA); Hwang, Chorng-Yuan (NCU); Chapillon Edwige (IRAM)

Starburst galaxies display intense star forming activity and eject molecular gas into the intergalactic medium through galactic outflows. This process plays a key role on galaxy evolution. NGC3628 is a nearby starburst galaxy with several kpc hot ionized outflows. We expected to see molecular gas exists in similar area of ionized outflows. The past CO observations do not detect galactic-scale molecular outflow due to its insufficient field of view and poor sensitivity. Our recent ARO CO observations detected molecular gas a few kpc above galactic disk. The limited angular resolution of those data prevents us to do a thorough study the morphology and the interaction between molecular gas and ionized gas. Right now we are using IRAM 30m CO observations with a significantly higher angular resolution to resolve the molecular gas distribution in the same area. We will present the newest results in this study.

S3.1

The JCMT/SCUBA-2 Transient Survey for the detection of accretion variability and transient phenomena

Bhavana Lalchand (National Central University, Taiwan); Wen-Ping Chen (National Central University, Taiwan); Steve Mairs (East Asian Observatory, Hilo, USA); Gregory J. Herczeg (Kavli Institute for Astronomy and Astrophysics, Peking University, People's Republic of China); Doug Johnstone (NRC Herzberg Astronomy and Astrophysics, & Department of Physics and Astronomy, University of Victoria, Canada)

Observations of temporal brightness and variability of stars provide physical insights to diagnose the stellar structure, e.g. the convective/dynamo mechanism. During the earliest phase of stellar assembly, when a protostar is vigorously accreting from circumstellar material, sporadic brightening events led by outflows (flares) are expected. Owing to the enshrouding dusty circumstellar material, optical/infrared detection is ineffective in detecting such protostellar flares. Here we report a dedicated program to monitor, on a monthly cadence to measure the accretion variability of protostellar candidates in star-forming regions with the James Clerk Maxwell Telescope (JCMT) using the SCUBA-2 bolometer array. This is the first time-domain submillimeter program, being carried out since 2015 for eight nearby star-forming regions such as IC348, NGC1333, Ophiuchus Core, among others. The program has successfully detected known 182 protostars (Class 0) and 800 disk sources (T-Tauri stars). A particularly important event in the stellar evolution is the emergence of flares during various magnetic reconnection led gyro-synchrotron radiation. We report the recent observation of such an extraordinary sub-mm flare by a T-Tauri binary JW566. We will present the detection algorithm for such events while also showing possible other candidate flaring events. Further, we will show the reconciliation of our observational statistical models with theoretical predictions.

S3.2

Diagnosing Triggered Star Formation in the Galactic HII region Sh 142

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Star formation does not occur in isolation. In a molecular cloud complex, there is usually an intricate interplay between gas and dust, newly formed stars, and remnant clouds which may or may not produce the next-generation stars. Massive stars, with copious UV radiation and fierce stellar winds, may disperse surrounding clouds, making subsequent star formation impossible. On the other hand, given proper conditions, the ionization of the surface layer of a nearby cloud, i.e., a bright-rimmed cloud, may lead to an implosive shock front to prompt and give birth to a new generation of stars. Diagnostic signposts of such a triggered star formation include the lining up geometry of the massive star(s), the bright-rimmed cloud, and the young stars in an age sequence. Here we report such evidence in Sharpless 142, a prominent HII region at 2.6 kpc, associated with the bright rimmed cloud BRC 43, and the open cluster NGC 7380. Young stellar objects exhibit excess of infrared emission because of circumstellar disk/envelop and can be identified using Infrared data. Our data include (1) 2MASS, WISE, optical photometry of the star cluster members and of the young stellar population in the region, and (2) CO isotopic line observations for spatial correlation with the molecular gas. We also study the kinematics of molecular cloud and found two kinematically and spatially separated cores belonging to same cloud ciomplex. We present the spectral energy distributions of embedded protostars along with their spatial distribution. Keywords- HII region, Ionisation front(IF), Bright rimmed cloud(BRC), Triggered star formation, sequential star formation

S3.3

Accretion Flows in a Young Class 0 Protostar: Lupus 3-MMS

Travis Thieme (NTHU), Shih-Ping Lai (NTHU), Sheng-Jun Lin (NTHU), Pou-Ieng Cheong (NTHU), Ka Ho Lam (UVa), Zhi-Yun Li (UVa), Bo Zhao (MPE)

Understanding how material accretes to the rotationally supported disk from the surrounding envelope of gas and dust in the youngest protostellar systems is important for describing the environments in which these disks are formed. Magnetohydrodynamic simulations of magnetized, turbulent disk formation usually show spiral-like streams of material (accretion flows) connecting the envelope to the disk. However, observations of accretion flows in these early stages of protostellar formation still remain poorly characterized due to their low intensity. Here, we present our analysis of 12m ALMA archival data (C18O, 13CO, 12CO and SO) towards the young Class 0 source Lupus 3-MMS. We find that weighting the data to shorter baselines uncovers extended stream-like structures connecting to the disk plane. We isolate the spatial positions and velocity structures using a dendrogram algorithm and compare to a simple ballistic infall model, the CMU Model. We find that most of the streams are well-described by the CMU model, and also do not resemble velocity components of the molecular outflow.

S3.4

Observational Constraint on Eccentricity of Protoplanetary Disk MWC758 with ALMA

Kuo, I-Hsuan (ASIAA/NTU); Yen, Hsi-Wei (ASIAA); Gu, Pin-Gao (ASIAA)

ALMA observations revealed an eccentric dust cavity with e~0.1 in the transitional disk MWC758. To investigate the origins of the eccentricity of the dust cavity, we analyzed the gas kinematics in the MWC758 disk using ALMA archival data of the 13CO and C18O 3-2 line emission and performed fitting with Keplerian disk models using the radiative transfer code DiskFit. We found significant velocity deviations from the best-fit Keplerian rotation at the radius of the dust cavity. We examined several possibilities that may cause the velocity deviations, such as pressure gradient, height of the emitting layer, infall motion, inner warp, and vortices. We found that an eccentric orbital motion in the disk best explains our results, and the eccentricity of the gas motion was estimated to be 0.1+/0.03 at the radius of the dust cavity. In this presentation, I will introduce our result and discuss its implications on dust-gas coupling and planet-disk interaction in the MWC758 disk.

S3.5

Looking into the high-mass star-forming core G335.579-0.272 MM1 with ALMA

Fernando Olguin (NTHU), Patricio Sanhueza (NAOJ), Vivien Chen (NTHU), Andres Guzman (NAOJ), Xing Lu (NAOJ)

Characterising the kinematics of massive cores is key to understand how high-mass stars in single or multiple systems form. These systems play an important role in galaxy evolution, but they can form by different mechanisms. Since high-resolution observations are needed to resolve individual cores, we are carrying a survey to look for binary/multiple systems in high-mass star forming regions with ALMA. One of the youngest and most massive star forming region in the Galaxy is located within the IRDC SDC335.579-0.272. Large scale infall motions have been observed in this region (Peretto et al. 2013), whilst ALMA and ATCA observations have started to resolve individual cores (Avison et al. 2015). In this presentation we will show the latest results from our analysis of 1.3 mm ALMA observations probing scales of 1000 au. These reveal a small clump of sources. We studied the kinematics of 2 sources which are likely forming high-mass stars: ALMA 1 and 3. The former is the most massive core in the region and its line emission shows rotation, infall and expanding motions in the circumstellar gas. The latter shows clear signs of rotation of an envelope and/or disc-like structure.

S3.6

25 AU Angular Resolution Observations of HH 211 with ALMA : Jet Properties and Shock Structures in SiO, CO, and SO

Kai-Syun Jhan (ASIAA); Chin-Fei Lee (ASIAA)

HH 211 is a highly collimated jet with a chain of knots and a wiggle structure on both sides of a young Class 0 protostar. We used two epochs of Atacama Large Millimeter/submillimeter Array (ALMA) data to study its inner jet in the CO(J=3-2), SiO(J=8-7), and SO(NJ=89-78) line at ∼25 AU resolution. With these ALMA and previous 2008 Submillimeter Array (SMA) data, the proper motion of 8 knots within ∼250 AU of the central source is found to be ∼0.066" per year (∼100 km/s), consistent with previous measurements in the outer jet. At ∼5 times higher resolution, the reflection-symmetric wiggle can be still fitted by a previously proposed orbiting jet source model. Previously detected continuous structures in the inner jet have been resolved, containing at least 5 sub-knots. These sub-knots are formed due to a variation in the ejection velocity of the jet with a period of ∼ 4.5 years, shorter than that of the outer knots. In addition, backward and forward shocks are resolved in a fully-formed knot, BK3, and signatures of internal working surface and sideways ejection are identified in Position-Velocity diagrams. In this knot, low density SO and CO layers are surrounded by a high density SiO layer.

S3.7

Interplay between Molecular Clouds and Young Objects in the Rho Ophiuchus

Aashish Gupta (National Central University); Wen-Ping Chen (National Central University)

The ρ Ophiuchus cloud complex, with its proximity (∼138 pc) and a high concentration of gas and stellar population in infancy (1-2 Mys), is a vintage laboratory to study macrophysics of star formation. Here we present the deepest 850-micron JCMT/SCUBA-2 image and most complete catalogue of Young Stellar Objects of the region. Using these datasets, we diagnosed the spatial and kinematic correlation of the young stellar population, at different evolutionary stages classified using SEDs, with respect to the gaseous structures. Among other interesting results, we can see a bound cluster forming in Oph A, simultaneously with star-formation.

S3.8

Deuterium Chemodynamics of Massive Pre-Stellar Cores

Chia-Jung Hsu(Chalmers University of Technology); Jonathan Tan(Chalmers University of Technology);
Matthew D. Goodson(University of North Carolina at Chapel Hill);
Paola Caselli(Max-Planck-Institute for Extraterrestrial Physics);
Bastian Körtgen(Universität Hamburg); Yu Cheng(University of Virginia)

High deuterium fraction of N2H+ (Dfrac_N2H+) is often observed in pre-stellar cores. However, the proper physical and chemical conditions to reach such high values are still under debate. To understand the required chemical conditions, we carry out a series of three-dimensional magnetohydrodynamics simulations of a massive prestellar core coupled with a sophisticated deuteration astrochemical network. We investigate the effects of initial ortho-para ratio of H2, temperature, cosmic ray ionization rate, CO depletion factor and initial chemical age. We find that high cosmic ray ionization rates and high CO depletion can allow the simulated Dfrac_N2H+ to match observational values in one free-fall time. However, while a lower initial ortho-para-ratio of H2 (OPR_H2) helps the growth of Dfrac_H2H+, the spatial structure of deuterium fraction is too widespread compared to observational data. We discuss the implications of our results for massive star formation theories.

S3.9

Evolution of grain size distribution in Milky Way-like galaxies in IllustrisTNG

Yu-Hsiu Huang (ASIAA/NTU); Hiroyuki Hirashita (ASIAA); Yen-Ting Lin (ASIAA); DylanNelson (MPA); Andrew Cooper (NTHU); Yun-Hsin Hsu (ASIAA/NTHU)

Interstellar dust plays an important role in radiative and chemical processes in galaxies. These processes depend on the dust properties such as dust abundance, grain size distribution, and chemical compositions. On the other hand, the evolution of dust is related to the interstellar properties and likely the galaxy assembly history. To understand the evolution of dust properties, especially the grain size distribution, in Milky Way-like galaxies, we apply our semi-analytical dust evolution model to the state-of-art cosmological simulation IllustrisTNG (TNG). We model the dust abundance and grain size distribution arising from stellar dust production, accretion, sputtering, coagulation, and shattering by post-processing a sample of mock galaxies from TNG. By using a cosmological simulation, we can track how the contributions of these processes respond to the evolution of gas content, metallicity and star formation rate over the lifetime of each galaxy. In addition, the galactic assembly history is properly taken into account by considering full merger trees of galaxies. Our predictions for grain size distributions and extinction curves therefore reflect the wide diversity of assembly histories that arise for Milky Way-like galaxies in LambdaCDM. Our results broadly reproduce the Milky-Way extinction curve at $z \leq 1$ and the dust--metallicity relation of nearby star-forming galaxies. Furthermore, we discover that the dispersion of the grain size distribution is minimized at $z=1$. This phenomenon may be due to the evolution of the metallicity and star-formation activities in the galaxies that lead to the equilibrium of the dust evolution processes.

S3.10

ALMA Survey of Orion Planck Galactic Cold Clumps (ALMASOP): Detection of New Hot Corinos with ACA

Shih-Ying Hsu (NTU); Sheng-Yuan Liu (ASIAA); Tie Liu (SHAO); the ALMASOP collaboration

We report the detection of four new hot corino sources from a survey study of Planck Galactic Cold Clumps in the Orion Molecular Cloud Complex with the Atacama Compact Array (ACA). We have observed abundant complex organic molecules (COMs), primarily methanol but also other oxygen-bearing COMs and the molecule of prebiotic interest NH2CHO, signifying the presence of hot corinos. While our spatial resolution is not sufficient for resolving most of the molecular emission structure, the large linewidth and high rotational temperature of COMs suggest that they likely reside in the hotter and innermost region immediately surrounding the protostar. Hydrocarbons and long carbon-chain molecules such as c-C3H2 and HC3N are also detected in the four sources, likely tracing the outer and cooler molecular envelopes.

S3.11

Hunting Trans-Neptunian Objects with the Hyper Suprime-Cam Deep Layers

Marielle R. Eduardo (NCU, ASIAA), Ying-Tung Chen (ASIAA), Shiang-Yu Wang (ASIAA), Wen-Ping Chen (NCU)

Trans-Neptunian Objects (TNOs) hold the pristine and critical informationnot only on the composition but also on the collisional evolution of the outer Solar System. However, information for these small and faint TNOs is still limited as observations require telescopes with large aperture and wide field of view. In this study, we use the data obtained by Hyper Suprime-Cam Subaru Strategic Program (HSC-SSP), which is one of the deepest wide-field surveys, that utilizes the 8.2m aperture of the Subaru Telescope from 2014 to 2019. Using the pipeline for detecting moving objects developed by Chen et. al (2018), we detected 95 new TNO candidates from the three distinct fields of the HSC-SSP DEEP layer survey data, particularly, 10 candidates from COSMOS, 65 candidates from DEEP2-3, and 15 candidates from XMM- LSS. The Deep layer covers a total area of 27deg2 and observes at a depth of about mr = 25.40 in a single frame with 180s of exposure time. Finally, with continuous tracking from observations in DEEP fields from about 300 nights, we are able to place accurate orbital elements, color estimate, and lightcurve information for objects in COSMOS and XMM-LSS fields.

S3.12

The light curve simulator and analysis pipeline for the TAOS II

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Transneptunian Automated Occultation Survey II (TAOS II) project aim of detect Trans-Neptunian Objects (TNOs) with diameters in the range of $0.3 < D < 30$ km. Since TAOS II three telescopes are separated widely and equipped the higher cadence CMOS sensor than TAOS I, the light curve simulator of TAOS I is inadequate for the needs of TAOS II. We base on original TAOS I simulator, the additions to the software package are append to the simulator, including the positions of three telescopes, the elevation and azimuth of the target star and the direction of the vector of the relative velocity between the TNO and observer. TAOS II will observe as many as 10,000 stars with three telescopes simultaneously, this will produce up to 70 million individual light curves. A very fast analysis pipeline for event detection and characterization is needed to handle this massive data set. The pipeline should be capable of real time detection of events (real time meaning within 24 hours of observations) for followup observations of any occultations by larger TNOs, and should be scalable for large simulations where many simulated events are added to the observed light curves to measure detection efficiency and biases in event characterization. We are showing how the pipeline detect and characterize the event by trigger algorithm and parameterization. With this pipeline, we may able to constrain the size and distance of TNOs with observed occultation light curve.

S4.1

OSSOS. XVIII. Constraining Migration Models with the 2:1 Resonance Using the Outer Solar System Origins Survey

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Resonant dynamics plays a significant role in the past evolution and current state of our outer Solar System. The population ratios and spatial distribution of Neptune's resonant populations are direct clues to understanding the history of our planetary system. The orbital structure of the objects in Neptune's 2:1 mean-motion resonance `twotinos' has the potential to be a tracer of planetary migration processes. Different migration processes produce distinct architectures, recognizable by well-characterized surveys. However, previous characterized surveys only discovered a few twotinos, making it impossible to model the intrinsic twotino population. With a well-designed cadence and nearly 100% tracking success, the Outer Solar System Origins Survey (OSSOS) discovered 838 trans-Neptunian objects, of which 34 are securely twotinos with well-constrained libration angles and amplitudes. We use the OSSOS twotinos and the survey characterization parameters via the OSSOS Survey Simulator to inspect the intrinsic population and orbital distributions of twotino. The estimated twotino population, 4400$^{+1500}_{-1100}$ with H_r<8.66 (diameter~100km) at 95% confidence, is consistent with the previous low-precision estimate. We also constrain the width of the inclination distribution to a relatively narrow value of σ_i=6°^{+1}_{-1}, and find the eccentricity distribution is consistent with a Gaussian centered on e_c=0.275 with a width e_w=0.06. We find a single-slope exponential luminosity function with α=0.6 for the twotinos. Finally, we for the first time meaningfully constrain the fraction of symmetric twotinos, and the ratio of the leading asymmetric islands; both fractions are in a range of 0.2--0.6. These measurements rule out certain theoretical models of Neptune's migration history.

S4.2

Revealing the Unknowns of Exoplanets through Transit Signals

Ing-Guey Jiang (National Tsing Hua University)

Several projects which lead to the constraint on exoplanetary orbital configurations, the constraint on exoplanetary atmosphere, and the detection of possible exoplanet candidates through transit observations, transit modeling, and machine learning will be presented.

S4.3

Upper mass stability limit of (co-orbital) horseshoe planets

A. Paula Granados C.; Aaron C. Boley

In this talk, we expand our research on the stability limit of two equal-mass planets in a horseshoe (coorbital) configuration and consider non-circular orbits. Through numerical simulations, we test the long term stability (up to 100 Myrs) of an arrange of two equal-mass planets with planet-to-star mass ratio ranging from 1E-4 to 5E-2 and initial period ratio between 1 and 1.1 (with a ~ 1 au). We also investigate the effect of three different initial eccentricities (i.e., e=0, 0.01 and 0.1) and two initial relative mean longitudes (dl = 60 and 180 deg) on the stability of these systems. Among other parameters, we calculate and analyze the coorbital period of the stable realizations; this period has a functional form which differs between the tadpole and horseshoe configurations, as discussed in this talk. Finally, we find that the upper mass stability limit for horseshoe planets in terms of the central mass, Mc, varies with the eccentricity. Respectively for e=0.0, 0.01 and 0.1, the corresponding stability limits are 2.5E-3 Mc , 1E-3 Mc and 5E-4 Mc, regardless of the initial relative mean longitude.

S4.4

Polarimetric and Radiative Transfer Modelling of HD 172555's Debris Disc

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The debris disc around HD 172555 was recently imaged in near-infrared polarised scattered light by the Very Large Telescope's instrument Spectro-Polarimetric High-contrast Exoplanet Research (SPHERE). Here we present optical aperture polarisation measurements of HD 172555 by the HIgh Precision Polarimetric Instrument (HIPPI), and its successor HIPPI-2 on the Anglo-Australian Telescope. We seek to refine constraints on the disc's constituent dust grains by combining our polarimetric measurements with available infrared and millimetre photometry to model the scattered light and continuum emission from the disc. We model the disc using the 3D radiative transfer code Hyperion, assuming the orientation and extent of the disc as obtained from the SPHERE observation. After correction for the interstellar medium contribution, our multi-wavelength HIPPI/-2 observations (both magnitude and orientation) are consistent with the recent SPHERE polarisation measurement with a fractional polarisation p = 62.4 ± 5.2 ppm at 722.3 nm, and a position angle θ= 67 ± 3°. The multi-wavelength polarisation can be adequately replicated by compact, spherical dust grains (i.e. from Mie theory) that are around 1.2 μm in size, assuming astronomical silicate composition, or 3.89 μm assuming a composition derived from radiative transfer modelling of the disc. We were thus able to reproduce both the spatially resolved disc emission and polarisation with a single grain composition model and size distribution.

S4.5

Missing water in disks around low-mass stars

Daniel Harsono (ASIAA)

Water is abundant in the solid phase prior to star formation as revealed by ice absorption studies of embedded protostars. In contrast, water toward Class II disks is significantly depleted. Since planets are formed in those disks, it is crucial to understand how it is being transported there from the large-scale envelope around protostars. Class I protostellar systems have been shown to host well-defined Keplerian disks on similar scales to that of Class II systems. Disks around Class I sources thereby provide an interesting link to trace the water evolution. We here present non-detections of spatially resolved warm water lines toward four Class I protostars from the IRAM NOEMA and ALMA. The stringent upper limits suggest that the chemical processing of water due to grain growth and photodissociation are known to take place in Class II disks, already start during the earlier embedded phases. Deeper water line observations are required to further constrain the dependence of the water vapor abundance on the physical structure of the Class I disks.

S4.6

Possible Time Correlation Between Jet Ejection and Mass Accretion for RW Aur A

Hiro Takami (ASIAA), Tracy L. Beck (STScI, USA) et al.

For the active T-Taur star RW Aur A we have performed long-term (~10 yr) monitoring observations of (1) jet imaging in the [Fe II] 1.644-micron emission line using Gemini-NIFS and VLT-SINFONI; (2) optical high-resolution spectroscopy using CFHT-ESPaDOnS; and (3) V-band photometry using the CrAO 1.25-m telescope and AAVSO. The latter two observations confirm the correlation of time variabilities between (A) the Ca II 8542 A and O I 7772 A line profiles associated with magnetospheric accretion, and (B) optical continuum fluxes. The jet images and their proper motions show that four knot ejections occurred at the star over the past ~15 years with an irregular interval of 2-6 years. The time scale and irregularity of these intervals are similar to those of the dimming events seen in the optical photometry data. Our observations show a possible link between remarkable (Delta_V < -1 mag.) photometric rises and jet knot ejections. Observations over another few years may confirm or reject this trend. If confirmed, this would imply that the location of the jet launching region is very close to the star (r <<0.1 au) as predicted by some jet launching models. Such a conclusion would be crucial for understanding disk evolution within a few au of the star, and therefore possible ongoing planet formation at these radii.

Revealing Ionization Conditions of the Young Star Sz 102 with Spatially Resolved [Ne III] Microjets

Chun-Fan Liu (ASIAA), Hsien Shang (ASIAA), Gregory J. Herczeg (KIAA/PKU), Frederick M. Walter (Stony Brook Univ.)

Spatially resolved [Ne III] spectra in the Sz 102 microjets were obtained through the Hubble Space Telescope Imaging Spectrograph (HST/STIS) at a spatial resolution of ∼0.”1. The majority of the microjet emission is confined within ∼0.”25 from the star, but with a fainter extension up to ∼0.”5. The blueshifted and redshifted [Ne III] emission both show peak intensity within ∼0.”1 of the star and gradually decay along the flow. Ca II H and K lines are also detected from the redshifted microjet, atop a 300-km/s wide stellar component. The spatial distribution and extent of the [Ne III] microjet is consistent with the scenario that the jet is ionized close to the base, most probably by X-rays hardened by magnetic reconnection induced by star–disk interactions above the disk mid-plane, and subsequently recombines with a recombination timescale longer than the flow time.

ALMA Survey of Orion Planck Galactic Cold Clumps (ALMASOP): Evolution from the prestellar core to protostars

Somnath Dutta (ASIAA, Taiwan); Chin-Fei Lee (ASIAA, Taiwan);
Tie Liu (SHAO, China); Naomi Hirano(ASIAA, Taiwan); Sheng-Yuan Liu(ASIAA, Taiwan); ALMASOP team

Planck Galactic Cold Clumps (PGCCs) are contemplated to be ideal targets to probe the early phases of star formation. We have conducted a survey of 72 young dense cores inside PGCCs in the Orion complex with the Atacama Large Millimeter/submillimeter Array (ALMA) at 1.3mm (band 6) using three different configurations (resolutions ~ 0.35, 1.0, and 7.0) to statistically investigate their evolutionary stages and sub-structures. We have obtained images of the 1.3 mm continuum and molecular line emission (e.g., 12CO, SiO) at an angular resolution of ~ 0.35 arcsec (140 au) with the combined arrays. We find 68 substructures within 48 detected dense cores where the dense substructures are clearly detected within the central 1000 au of four candidate prestellar cores. The envelope sizes and masses are found to be significantly reduced with protostellar evolution from Class 0 to Class I. Around 70% of the protostars exhibit bipolar CO outflows, whereas, more than 60% outflows are associated with high-velocity SiO jets. The outflow characteristics show an evolutionary change through the course of protostellar mass accretion. The CO velocity-dispersions (ΔVs) and the outflow cavity opening angle width at 400 au, [Θobs]400 (~ 0. 6 to 3. 9 arcsec; corresponds to 33. 4 - 125.7 deg near the source) show an increasing correlation, suggesting that as protostars undergo gravitational collapse, the cavity opening of a protostar envelope widens and the protostars generate more energetic outflows from a deeper gravitational potential well. Astrochemical diagnosis of the molecular species incorporates the chemical diversity from starless (abundant deuterated species like N2D+, DCO+) to the protostellar phases with a subset of line-reach "hot-corinos" (CH3OH, H2CO and their complex organic molecules).

S5.3

The ALMA View of Complex Chemistry toward Embedded Protostars

Yao-Lun Yang (University of Virginia)

Planet formation may start during the embedded phase of star formation. In this scenario, the chemistry of embedded disks may directly determine the chemical composition of the forming planets. In recent years, observations discover several embedded protostars that have developed complex chemistry at the disk-forming region. However, only a few observations attempt to constrain the occurrence of complex molecules at embedded protostars and their relationships to star formation processes. I will present the first result of the Perseus ALMA Chemistry Survey (PEACHES), which aims to unbiasedly survey the chemistry toward 47 embedded protostars with a spatial resolution comparable to the size of disk-forming region. In PEACHES, we identify a variety of molecules and their isotopologues, including CCH, c-C3H2, SO, SO2, CH3OH, CH3CN, CH3OCHO, CH3OCH3, and C2H5OH. For the protostars with emission of complex organic molecules, we find their column densities of complex organic molecules correlate well between species, hinting a similar chemistry for Perseus protostars. Protostellar properties, such as bolometric luminosity and bolometric temperature, have little impact on the occurrence of complex organic molecules. I will also discuss the comparison with the chemistry of the protostars at other regions and environments. The occurrence rate of different complex molecules learned from the PEACHES survey will provide a primer for constraining chemical evolution during the star formation.

S5.4

Constraints of the formation and abundances of methyl carbamate, a glycine isomer, in hot corinos

Dipen sahu (ASIAA); Sheng-Yuan Liu (ASIAA); Ankan Das (ICSP); Prasanta Garai (ICSP); and Valentine Wakelam (LAB)

Methyl carbamate CH3OC(O)NH2 is an isomer of glycine. Quantum chemical analyses show that methyl carbamate is more stable isomer than glycine. Because of this, there could be a higher chance for methyl carbamte to exist in the interstellar medium as compared to glycine. Despite immense searches, till now glycine has not been detected in the ISM, therefore it is worthwhile to search its isomer methyl carbamate. In this paper, we present the constraints of methyl carbamate formation under the interstellar conditions. Large complex organic molecules are favorably produced in hot- corino environments of low mass protostars. We for the first time carried out astrochemical modeling focusing on the formation of methyl carbamate in physical conditions similar to hot-corino objects. Consequently, we examined ALMA archival data for existing spectral line observations toward hot corinos NGC1333 IRAS 4A2 and IRAS 16293B. Within the common spectral range towards these sources, we found three features are possibly related to the spectral transitions of methyl carbamate and consequently estimate the upper limit of column densities. Results of chemical modeling are consistent with the observational upper limit of estimated column density/abundance toward the sources. This may hint the validation of the proposed formation mechanism. Future observations using telescope like ngVLA may confirm the presence of MC toward the hot corinos.

S5.5

Formation of the Hub-Filament System G33: Interplay between Gravity, Velocity, and Magnetic Field

Jia-Wei Wang, Patrick M. Koch, Hauyu Baobab Liu, Shih-Ping Lai

How filaments form from molecular clouds and evolves to stars is a key question in the field of star formation. Hub-filament system (HFS) is a transition stage connecting parsec-scale filaments and forming protocluster, and hence understanding the origin of HFS is crucial to reveal how star formation proceeds between the clouds to core scales. In this work, we report the JCMT POL-2 850 micron polarization observations and the IRAM 30-m C18O (2-1) observations toward the approximately face-on, massive, HFS G33.92+0.11. The 850 micron continuum map shows four major filaments converging to the massive center of G33.92+0.11 with numerous short filaments converging to the major filaments. We estimate the direction/orientation of filaments, magnetic fields, local gravitational force, and local velocity from the observed data, and systematically examine their cross correlation. In the high-density areas, our analysis shows that filaments tend to align with magnetic fields and local gravity in the high-density areas. In the low-density areas, we found that the local velocity gradient tends to perpendicular to both magnetic fields and the local gravity, although filaments still tend to align with the local gravity. In addition, our virial analysis suggests that the gravitational energy dominates the magnetic and kinematic energy. Based on these results, we interpret that the formation of the G33.92+0.11 HFS was predominately driven by gravity, which captures and drags both the major filaments and the magnetic fields accreting into the massive center. In the diffuse areas, the ambient gas might be accreted onto the major filaments directly or via short filaments, and this kinematic is traced by the observed local velocity gradient.

S5.6

Probing Magnetic Fields in the Circumgalactic Medium

TIng-Wen Lan (UCSC)

Gas around galaxies, the circumgalactic medium (CGM), plays an essential role in our understanding of galaxy evolution. It is the interface between galaxies and the intergalactic medium where gas accretion and outflows --key drivers of galaxy evolution-- leave their signatures. To better understand the origin and fate of the CGM, it is crucial to probe magnetic fields around galaxies, a key component that controls the structure and survival of the CGM as suggested by recent magnetohydrodynamic simulations. In this talk, I will show that one can extract the properties of magnetic fields in the CGM by correlating Faraday rotation measures (RMs) of ∼1000 high-redshift radio sources with the foreground galaxy number density estimated from the DESI Legacy Imaging Surveys. By doing so, we are able to obtain strict upper limits of RMs and corresponding magnetic field strengths around galaxies. Finally, I will show that our upper limits are sufficient to constrain outputs of recent galaxy magnetohydrodynamic simulations.

S5.7

The drag instability in 1D isothermal C-shock in typical star-forming clouds

Pin-Gao Gu (ASIAA); Che-Yu Chen (Univ. of Virginia)

We investigate whether the drag instability, proposed by Gu et al., occurs in a one-dimensional (1D) C-shock. The 1D background model proposed by Chen & Ostriker for a steady isothermal C-shock is adopted, and a 1D isothermal linear analysis is performed. We confirm the postulation of Gu et al. that the drift velocity between ions and neutrals is sufficiently high within a C-shock to allow for the drag instability. We also study the underlying physics of the decaying modes in the shock and postshock regions. The drag instability is an overstability phenomenon associated with an exponentially growing mode of a propagating wave. We find that the growing wave mode can only propagate downstream within the shock and subsequently decay in the postshock region. The maximum total growth for such an unstable wave before it is damped is estimated in typical environments of star-forming clouds, which is approximately 10-30 times larger than the initial perturbation at the modest shock velocities and can be significantly enhanced several hundred times for a stronger C-shock with a larger width.

S6.1

Exploring the size distribution of dust grains in the interstellar medium using infrared and X-ray spectroscopy

Sascha Zeegers (ASIAA); Ciska Kemper (ESO/ASIAA); Stefan Bromley (Universitat de Barcelona); Joan Mariñoso Guiu (Universitat de Barcelona); Elisa Costantini (SRON); Daniele Rogantini (SRON); Irene Abril Cabezas (Universidad Complutense de Madrid); Cor de Vries (SRON); Ioanna Psaradaki (SRON); Missagh Mehdipour (SRON)

The size distribution of interstellar dust particles plays an important role in many astronomical models. However, we can only infer the sizes of the grains with indirect methods. This has resulted in many different size distribution models and it is difficult to discriminate between them. Infrared and X-ray spectroscopy offer important tools to solve this problem. The infrared provides the possibility to study the small-end of the size distributions of silicate grains (a major component of interstellar dust). Here we can observe the effect of silicate nano-grains on the spectra of infrared sources. Small silicate nano-grains may provide insight in the formation of grains in the interstellar medium (ISM), since the observation of these small clusters may point to active grain formation in the ISM. They may also explain the absence of crystalline dust in ISM, since many atoms are near the surface of the grain, distorting the lattice structure, which may make the grains appear amorphous while they are still in their lowest energy configuration. In the X-rays, bright low mass X-ray binaries are particularly useful to study dust in the interstellar medium of the Galaxy. We can use them as background sources to probe the intervening dust along the line of sight. Features in the spectra of these sources reveal information about the composition and size of the dust particles. The X-ray absorption edges of silicon and magnesium are particularly useful. These edges contain scattering features caused by dust grains, which can be directly linked to the particle size of the dust grains. In this talk, I will show the possibilities of studying the X-ray binaries in the Galaxy in order to constrain the dust size distribution. I will focus on the upcoming Athena X-ray Observatory (expected launch date 2030), which will be capable of discriminating between different dust models thanks to the high spectral resolution of the X-IFU instrument. From the infrared side I will discuss the properties of small silicate grains making use of archival Spitzer spectra and the possibilities to observe them with JWST and SPICA.

S6.2

Disentangling Dust Properties, Grain Alignment And Magnetic Field Structure With Multi-Wavelength Submillimeter Polarization

Lapo Fanciullo (ASIAA)

Interstellar dust grains are generally non-spherical and their major axes tend to orient perpendicularly to magnetic field lines. The net result of this is that thermal emission from dust is polarized, and this polarization provides information not just on dust itself, but also on the orientation of interstellar magnetic fields. The study of polarized dust emission – which is found mainly at far-infrared and submillimeter wavelengths – is central to many astrophysical fields, from the study of dust itself, to CMB analysis (as a foreground), and magnetic field mapping on both Galactic and molecular cloud scales. Unfortunately, interpreting the polarization fraction in emission (P/I) is a non-trivial task, since this quantity is determined by several factors: the orientation and structure of the magnetic field, the grain alignment efficiency and the optical properties of dust itself. As an example, the well-known drop of P/I at high column density is often used to trace the loss of grain alignment in molecular clouds, but the analysis is complicated by the complex magnetic field inside these clouds, which also plays a role. The possibility that polarization efficiency may be different for dust in cloud cores (due to dust processing such as accretion and coagulation) further complicates the picture. Studying the spectral shape of dust polarization can help break this degeneracy, since the effects of magnetic field and alignment on P/I are expected to be independent of wavelength at first approximation. Returning to the example above, multi-wavelength polarimetry could be the key to studying how dust polarization cross-sections evolve in dense clouds. As part of the BISTRO project (B-fields In STar-forming Region Observations), I lead a team to combine 850 μm polarimetry from JCMT and 150–210 μm polarimetry from SOFIA to recover a polarized spectrum for Gould Belt clouds. I will show our latest results for NGC 2071 in Orion B. I will also explain the importance of using long-wavelength ($\lambda > 500$ μm) data in multi-wavelength polarimetric studies.

S6.3

Evolution from Spherical AGB Wind to Multipolar Outflow in Pre-planetary Nebula IRAS 17150−3224

Po-Sheng Huang (ASIAA/NTU); Chin-Fei Lee (ASIAA/NTU); Raghvendra Sahai (JPL)

We have mapped the pre-planetary nebula IRAS 17150−3224 in the 350 GHz continuum and CO J=3–2 line at an angular resolution of ~0".09 using the Atacama Large Millimeter/submillimeter Array. A continuum source is detected at the center of the nebula, elongated along the equatorial plane, likely tracing a dusty torus around the central source. Continuum emission is also detected on both sides of the central continuum source in the equatorial plane, probably resulting from interactions of collimated fast winds (CFWs) with envelope material in the equator. CO emission is detected along the optical lobe. Although the optical lobe appears as bipolar, the CO map shows that it is actually a quadrupolar outflow consisting of two overlapping bipolar outflows. Two additional younger bipolar outflows are also detected in CO, one at the lower latitude and the other along the equatorial plane. In the CO position–velocity maps, blueshifted absorption stripes are detected in the outflow emissions, due to absorption by a series of shells produced by a series of asymptotic giant branch (AGB) wind ejections. By modeling the morphology and kinematics of the AGB wind and outflows, we find that the AGB wind could have ended ~1300 yr ago, the quadrupolar outflow was ejected ~350 yr ago, and the two additional bipolar outflows were ejected ~280 and 200 yr ago, respectively. The outflows could be produced either by bullets coming from an explosion, or by a precessing CFW with a time-dependent ejection velocity.

S6.4

The Radial Acceleration Relation in CLASH Galaxy Clusters

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The radial acceleration relation (RAR) in galaxies presents a tight empirical scaling law between the total and baryonic acceleration with a characteristic acceleration scale of g†=1.20×10-10 ms-2. From 20 high-mass clusters targeted by the Cluster Lensing And Supernova survey with Hubble (CLASH), we examine the existence of such a relation in galaxy clusters using weak-lensing, strong-lensing, and X-ray data sets. By combining our CLASH data with stellar mass estimates for the brightest cluster galaxies (BCGs) and accounting for the stellar baryonic component in clusters, we reveal, for the first time, an RAR on BCG--cluster scales. The resulting RAR shows the same functional relation as the low acceleration limit of the RAR in galaxies but with a higher acceleration scale g‡=2.0×10-9 ms-2. We find that the new RAR in CLASH clusters is consistent with the semi-analytical model developed in the standard ΛCDM framework. Our results also imply a baryonic Faber--Jackson relation on cluster scales.

S6.5

HO Puppis: A Sub-Luminous Hot Star with IW-And Type Light Curve

Chien-De Lee (Graduate Institute of Astronomy, National Central University);
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Po-Chieh Huang (Graduate Institute of Astronomy, National Central University);
Wing-Huen Ip (Graduate Institute of Astronomy, National Central University); Franz-Josef Hambsch (AAVSO);
Hyun-il Sung (Korea Astronomy and Space Science Institute (KASI), Bohyunsan Optical Astronomy Observatory (BOAO));
Jan van Roestel (Division of Physics, Mathematics, and Astronomy, California Institute of Technology); ZTF buliders

HO Puppis (HO Pup) was considered a Be star candidate based on its γ Cassiopeiae-type light curve, but lacked spectroscopic confirmation. Using distance measured from Gaia Data Release 2 and the spectral energy distribution (SED) fit on broadband photometry, the Be star nature of HO Pup is ruled out. In contrast, the SED of HO Pup can be well fit with a hot and sub-luminous star or, possibly, a hot subdwarf. Furthermore, based on the 28,700 photometric data points collected from various time-domain surveys and dedicated intensive monitoring observations, the light curves of HO Pup closely resembles IW And-type stars (as pointed out in Kimura et al. 2020), exhibiting characteristics such as a standstill phase, outbursts and dips. The light curve of HO Pup displays various variability timescales, including outbursts cycles ranging from 23 to 61 days, variations with periods between 3.9 days and 50 minutes during the standstill phase, and a semi-regular ∼14 day period for the dip events. We have also collected time-series spectra (with various spectral resolutions), at which Balmer emission lines and other expected spectral lines for an IW And-type star were detected (even though some of these lines were also expected to be present on Be stars). We detect Bowen fluoresces near the outburst phase and that can be used to discriminate between IW And-type stars and Be stars. Finally, despite only observing for 4 nights, the polarization variation was detected, indicating that HO Pup has significant intrinsic polarization.

S6.6

Commissioning the Yuan-Tseh Lee Array

Kai-Yang Lin (ASIAA), YTLA Team

In the past two years, we have been using the Yuan-Tseh Lee Array (YTLA) for various science verification observations while tuning up the performance of the array. In this talk, I will highlight some of the results showing the characteristics of the array. In the initial test of deep integration, we have found an obstacle, a spurious signal in the system. We used field-subtraction to remove this spurious signal. I will demonstrate our current status of the deep integration using this technique. On the other hand, we have also identified the source of the problem and implemented a solution. Upon verification with on-site testing, we would soon resume the intensity mapping observations with YTLA.

S6.7

Design of a newly opened course "Astroinformatics" at National Central University

Daisuke Kinoshita (NCU)

Nowadays, computer programming is getting more and more important for astronomical research. We now have a flood of data, and we cannot analyse the data without making a computer program for our own purpose. Ability to write a computer program accelerates our research activities for observational data analysis, processing of archived catalogues, and model calculations. In March 2020, a new course named "Astroinformatics" was opened at National Central University. This course focuses on programming skills necessary for master course students for their research work. Students bring their own computers to the classroom, and tackle to a series of exercises. The official programming language of the course is Python. At the beginning of the semester, I started from basic topics, such as basic grammar of Python, doing simple calculations, making various plots, doing database queries, and carrying out least-squares method. Then, I arranged astronomical topics, such as period search techniques, blackbody radiation, planetary motions, making a HR diagram using Gaia data, at the second half of the semester. I report the design of the course and some feedbacks from students.

E1.1

ASIAA EPO 與 "AEIOU"

Lauren Huang

AEIOU stands for Awareness, Enjoyment, Interest, Opinions & Understanding of science. It is a set of criteria widely used among science communicators since 2005. I will show the ASIAA EPO activities in 2019 & 2020 to see how they fit into these 5 "categories". More importantly, I will introduce the ASIAA EPO team's new efforts in the "Understand" part, a "glossary for the teens" and the related wish list for the future.

E1.2

特殊天象觀察融入社區教育與終身學習

洪景川(台北市天文協會，台北市士林與文山社區大學)

社區大學天文課程在期末與暑假中，由於團報與假期無團保等校務主觀因素，一般而言校方不鼓勵進行校外教學野外觀星的課程。運用 2020 年 6 月 21 日台灣日環食與 2020 年 7-8 月間 C/2020 F3 Neowise 彗星兩件特殊天象的彈性教學與觀察和攝影，技巧性地規避社大行政上的規範，也促使選課學員們儘可能學到原理，瞭解現象之餘，還皆能親眼觀察，動手紀錄，開口分享難得的特殊天象。落實生活中學習，日常間觀察的精神，將鮮活上演中的宇宙史帶入所有學員的生命中。 關鍵字 ： 特殊天象，日環食，明亮彗星，社區大學天文班，終身教育。

E1.3

流星撞擊月閃光觀測系統建立與教學應用

李瑾

當流星體撞擊月球時，部分撞擊能量會形成隕石坑，少部分因熱輻射產生可見光。由於事件發生的時間與位置為隨機，發光現象僅 0.5 秒內相當短暫，因此在近代 CCD 相機發展後才觀測到較多的事件。由於較亮的月閃光事件，使用口徑僅十幾公分以上望遠鏡與業餘級 CCD 相機即可看到，適合一般學校或天文業餘愛好者觀測。臺北天文館、東華大學與中央大學所組成的流星觀測團隊，於 2017 年起於觀測月閃光，獲得初步成果。本報告將介紹團隊這幾年月閃光觀測成果，以及分享觀測設備與觀測方法，以利教育的應用與推廣

E1.4

建立館校合作學習模式-行動天文館成果初探

林琦峯

臺北天文科學教育館(以下稱天文館)身為社教機構，屬於非正規教育的一環，在鼓勵多元學習的時代中，可以扮演輔助學校制式教育的關鍵角色。天文館推出「行動天文館校園趴趴 GO!」計畫，提供一系列「行動展演模組」借展至臺北市及新北市的國中及小學，協助學校打造一個「行動天文館」，搭配「科普講座」及「望遠鏡觀星」活動，讓學校的學習空間變得更豐富，讓老師的教學手段更多元，藉以提升學生的學習動機與學習自發性，獲得更深入的學習。天文館積極的走進校園，建立館校合作的學習模式，培養學生科學探究與實作能力，提升學校師生對天文科學的興趣。本研究透過問卷調查，期望了解參與者學習態度及天文知識的學習成效。

E1.5

中小學太陽相關課程之天文輔助教具簡介

張桂蘭/臺北市立天文科學教育館

為配合中小學的太陽相關課程，開發了「太陽在天空中的運動」與「日晷 DIY」等相關課程。其中，「太陽在天空中的運動」課程可以透過教具的製作與課堂應用，無須讓學生每日實際在太陽下觀察，也可以學習太陽一天中與一年中在天空中的運動軌跡。「日晷 DIY」透過 Shadows Pro 免費軟體的應用，可自製日晷，除了可以學習時間與時間的制訂規則，並可瞭解不同日晷的運作和使用方式，以及相關的太陽運動模式。

P-1

Multi-wavelength transit photometry of exoplanets for star spot study

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Chia-Lung Lin(Graduate institute of astronomy, National Center University)

Photometric transit light curve measurements are an important technique to detect and study exoplanets. It has been shown that the small-scale structures observed can be used to derive the physical properties of star spots on different stars such as their size distribution, life time distributions and magnetic cycles (Silva, 2003; Silva-Valio, et al., 2010, 2011; Valio, 2017). Multi-wavelength transit photometry (MWTP) can hence provide more precise information on the temperatures of the cold spots and the hot active regions. In this study, we will present preliminary results of our model simulations of star spot activity in terms of transit photometry.

Search for the Molecular Exosphere on Enceladus

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Hsien-Ju, Tsai(蔡顯如) (Department of Earth Sciences, National Taiwan Normal University),
Guan-Ting, Su (蘇冠庭)(Department of Physics, National Taiwan Normal University)

Enceladus, a small icy moon of Saturn and approximately 500 km in size, has caught tremendous attention since the Cassini space probe found water plumes in the south polar region of the moon. This unexpected discovery of the plumes may imply the existence of an exosphere on Enceladus. Moreover, with measurements of the gravitational field and the physical libration, a global ocean beneath the ice shell of Enceladus is suggested as a source of the plume. To investigate the nature of Enceladus' exosphere, we made a series of observations with Atacama Large Millimeter/Submillimeter Array (ALMA) and imaged Enceladus successfully regardless the diminutive angular size of ~0".08. In this meeting, we will present preliminary results of our work.

First result of bacteria growth in primordial H2 atmosphere at NCU

Yao Hsiao (IANCU); Chia-Lung Lin (IANCU); Che-Wei Lu (NCULS); Shih-Ching Chen (NCULS); Wing-Huen Ip (IANCU)

Due to the advanced capability of next generation ground-based and space telescopes, using atmospheric biosignatures to search for life become possible. Since the idea of existence of atmosphere with mainly hydrogen has been mentioned and terrestrial exoplanets with H2 atmosphere are easy to observe, can life adapt and survive in such a peculiar environment become an interesting question. In this study, we demonstrate the laboratory experiment of B10 E.coli growing in 100% H2 gas and high percentage of CO2 gas to see the viability of life in exotic surface environment and investigate diverse possibility of environment which life may exist.

P-4

Saving low-mass planets from orbital migration in dusty disks

He-Feng Hsieh (NTHU, ASIAA); Min-Kai Lin (ASIAA)

Disc-driven planet migration is integral to the formation of planetary systems. In standard, gas-dominated protoplanetary discs, low-mass planets and/or planetary cores undergo rapid inwards migration and are lost to the central star. However, several recent studies indicate that the solid component in protoplanetary discs can have a significant dynamical effect on disc-planet interaction, especially when the solid-to-gas mass ratio approaches unity or larger and the dust-on-gas drag forces become significant. In this work, we study planet migration in dust-rich discs via a systematic set of high-resolution, two-dimensional numerical simulations. We show that the inwards migration of low-mass planets can be slowed down by dusty dynamical corotation torques. We also identify a new regime of stochastic migration applicable to discs with dust-to-gas mass ratios $Z \gtrsim 0.3$ and particle Stokes numbers $St \gtrsim 0.03$. In these cases, disc-planet interaction leads to the continuous development of small-scale, intense dust vortices that scatter the planet, which can potentially halt or even reverse the inwards planet migration.

P-5

Quasi-Periodic Pulsation in Radio Emission of Solar Flare

Po Chih Hsu (Department of Atmospheric Science, NCU); Ya Hui Yang (Department of Space Science and Engineering, NCU)

Quasi-periodic pulsation (QPP) is believed to be associated with solar flares, which can be observed in various frequencies of EM spectrum, such as radio, X-ray and microwave. I used the Chinese Solar Broadband Radio Spectrometers (SBRS) to search for the candidates of flare-related QPPs. The SBRS can measure the solar radio flux with right-hand and left-hand circular polarizations, which is helpful to differentiate the possible causes from these two polarizations. In this study, the 2.6-3.8 GHz data with a time resolution of 8 ms and a spectral resolution of 0.01 GHz are used. The source of QPPs appeared at such radio frequency range is supposed to occur in the solar atmosphere. I analyzed twelve QPP events from 2011 to 2013 by Fast Fourier Transform and wavelet analysis to find the characteristic period and other spectral parameters of QPPs.

Characterization of the space weather effects of some habitable exoplanets

Li-Ching Huang, Wing-Huen Ip, Chia-Lung Lin, Yao Hsiao and Fiona Chang

A good environment of a habitable exoplanet includes the following conditions, e.g., the surface temperature and pressure that water can be kept in liquid state on the planetary surface. The space weather effect is also important to the habitability (and sustainability) issue. That is, strong magnetic field activity of a host star would produce anomalous X-ray and UV radiation that are harmful to the biosphere in existence. Interaction of the energetic charged particles impacting the exo-planetary atmosphere could lead also to atmospheric loss or modification of the atmospheric composition. In this study, we analyze the flare activities of a number of solar-type stars with potentially habitable exoplanets by examining the light curves from the Kepler mission. Using the chronology of Earth's biosphere as a "standard candle", the developmental phases of' the hypothetical biospheres of individual exoplanets (i.e., Kepler-62e, Kepler-62f, Kepler-186f, Kepler-442b, Kepler-452b, Kepler-1229b, and Kepler-1638b) are compared. For those with very thin atmospheres, the possible existence of a deep hot biosphere is also considered.

以科學定年法探討行星之構造運動

Ming-Hung Kao (Taipei Astronomical Museum)

以科學定年法探討行星之構造運動 英國地質學家赫登（James Hutton）於 1785 年提出「均變說」，也就是「古今一致說」，闡明地球上過去和現在進行的地質作用之間的關係，成為地球科學家研究地球歷史的重要基礎。依據「均變說」，現在與過去所發生的地質作用基本原理相同，只不過規模與速率可能不同。也就是說，我們可以從觀察現在進行的地殼變動，以及地層中的物質與構造，追溯地球演變的歷史。類地行星演化的過程都經歷一段的高溫作用的歷史，行星高溫的岩漿冷卻過程中會形成一系列的礦物結晶，把這些礦物結晶與溫度的關係，配合科學定年法測定年代，就形成了溫度－時間對比表，分析行星岩體內一些指標性礦物，就能獲悉行星演化溫度變動的歷史。以地球的演化為例，在 46 億年的漫長演變歷史中，地殼變動事件頻繁而複雜。地殼中的礦物如磷灰石、鋯石、榍石、黑雲母與白雲母等，兼具「古溫度記錄器」與「定時器」的功能，科學家利用這種礦物與溫度關係的特性，配合其他科學定年法 (例如：fission-track、biotite K-Ar、 biotite Ar-Ar) 定年資料，發展出來的「記溫時鐘」（thermal-time clock）分析法，是研究類地行星構造運動的極佳工具。科學家們應用特殊科學定年法所獲得的定年資料，提供科學家們探究行星演變的的過程，並能進一步了解行星的演化歷史。 關鍵字： 定年法 Dating methods; 構造運動 Tectonics；核飛跡 fission-track

P-8

A comparative study of the orbital evolution of Atira and Vatira asteroids

Hsuan-Ting Lai (National Central University); Wing-Huen Ip (National Central University)

The TANGO consortium which is composed of NCU and NTHU is a partner to the ZTF project led by Caltech. It participates in the Twilight Survey of ZTF that was especially designed to detect asteroids with orbits inside Earth's orbit. These objects called atiras (orbits totally inside Earth's orbit) or vatiras (orbits totally inside Venus' orbit) are difficult to observe because of the strong sun glares. The Twilight Survey has proven to be a great success with the discoveries of several atiras, and the first vatira, 2020 VA2, on January 4, 2020. Upon the announcement of its discovery, a number of orbital studies have been performed (and published) to assess the orbital evolution of this km-sized asteroid. In the present work, we will consider the non-gravitational Yarkovsky effect on the long-term orbital variation of 2020 VA2. In addition, we will assess the Yarkovsky effect-driven orbital evolution of atiras and vatiras of smaller sizes.

P-9

Possible Near-Nucleus Environment of Main Belt Comet 133P/Elst-Pizarro

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Liang Liang Yu (Macau University of Science and Technology); Wing Huen Ip (NCU)

Comet 133P/Elst-Pizarro is the first discovered and one of the best-characterized main-belt comets. As officially selected as a prime target of the first Chinese small-body mission, models investigating 133P’s activity and the near-nucleus environment by integrating our knowledge of previous missions and observations would be very useful in the mission planning and instrument designs. Here we present comprehensive simulations from models representing 133P’s thermal, gas, and dust environments by considering different initial conditions such as spin axes, activity distributions, and orbital positions. Results show that different spin axes and orbital positions alter the surface temperature dramatically but hardly affects the subsurface temperature. In addition, local outgassing activities possibly driven by the exposed ice patches on the nucleus surface may be a better explanation for 133P's behavior given certain constraints derived from previous observations.

P-10

Lulin observations of the Barbarian asteroids

Kang-Shian Pan(NCU), Win-Huen Ip(NCU), Alberto Cellino(INAF)

A joint Taiwan-Torino polarimetric survey of the Barbarian asteroids with anomalous polarization behavior at large phase angles (α) is proposed. The CAI-rich Barbarians might provide key information on the formation processes of the solar system and the collisional history of the asteroid belt. We use the Triple Range Imager and Polarimeter (TRIPOL) on the one-meter (LOT) telescope on Lulin Observatory to measure the long-term phase-polarization curve which would be an important step in the exploration and understanding of this new class of very ancient asteroids. The report show the preliminarily observation result of Barbarian asteroids, (437) Rhodia and (824) Anastasia, by TRIPOL observation in this summer.

P-11

Generation of superthermal hydrogen beams in the vicinity of the Saturnian rings

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Institute of Astronomy, National Central University, Taiwan);
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The Ion Neutral Mass Spectrometer (INMS), the Cassini Dust Analyzer (CDA) and the MIMI energetic charged particle experiments detected large fluxes of small nanodust grains during the ring plane crossing of the Cassini spacecraft in its Proximal mission. It has been further suggested by Mitchell et al. (Science, 362, 50, 2018) that the collisional interaction between the infalling dust grains and the hydrogen exosphere will lead to the production of a thin-disk population of high-speed H-atoms and H2-molecules in eccentric or escaping orbits. This scenario is interesting because such a process might be associated with the unexplained UVSI observation of a narrow hydrogen gas plume emitted from the near-surface region of Saturn (Shemansky, Liu and Merlin, Planet. Space Sci., 57, 1659, 2009). In this work, we will re-examine the orbital motion of ring dust particles of different masses by assuming a dust size frequency distribution. Using the dust mass influx values estimated by INMS and MIMI as constraints, the production rates of the putative high-speed hydrogen gas plume will be estimated from a set of Monte Carlo model calculations.

P-12

Study of D68 Dust Material Flow Affected by Electrodynamics

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The narrow ringlet D68 with a width of 10 km and a radial distance of 67630 km from the center of Saturn has been considered to be the source of the tiny dust grains detected by the Cassini spacecraft during the ring plane crossings in its Proximal mission. Hedman (Icarus, 323, 62, 2019) gave a detailed analysis of the clumpy structures (T, M, L, LL) of D68 and their time evolution between Day 2016-071 and Day 2017-229.It was shown that the clumps would gradually disperse while drifting with a rate of 2 deg/yr to 8 deg/yr relative to the Keplerian rotating frame. In this study, we simulate the time evolution of a dust cloud of micron-sized particles under the influence of Lorentz force. We also compare the trajectories and orbital evolution of submicron grains ejected from the largest clump (M) with a view to produce a comprehensive picture of the inflows of ring material to the Saturnian atmosphere.

P-13

A Cometary Atlas of Kepler Observations

Ting-Shuo Yeh (IANCU) and Wing-Huen Ip (IANCU)

It is very easy to figure out the specific star in which scientists are interested in the Kepler and K2 mission database. However, it is very difficult to find out small solar system bodies in the database. Actually, there is no simple way that can directly filter out the small solar system bodies from the Kepler and K2 mission database. Therefore, we start our project to build a cometary atlas of Kepler observation to make things easier. The main goal of this project is to make a simple searching engine that can tell users where they can find (and download, if it is available) the raw images that included the specific target. We would like to build the map of those known and bright comets to test the system. More details will show in the poster.

P-14

Spectroscopic Line-Profile Variations of a Planet-Hosting A-Type Star WASP-33

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We present the results of the study of pulsation line-profile variations of exoplanet host A-type Delta-Scuti star WASP-33. The high-resolution spectroscopic observations were taken in 2015 using the High Dispersion Spectrograph (HDS) of the Subaru 8.2-meter telescope. Least-Squares Deconvolution (LSD) technique was used to construct a mean profile and enhance the S/N. The analysis of LSD profiles shows the existence of high-degree prograde non-radial pulsation. We discuss these obtained results together with the results of the photometric studies of the pulsation spectrum.

P-15

搜尋疏散星團 NGC 6834 中的短週期變星

張桂蘭

本報告分析位在天鵝座與狐狸座邊界的疏散星團 NGC 6834 於 2018/10/2-10/4 連續 3 晚的鹿林觀測影像，透過差異測光方式，搜尋該星團中是否有周期在數小時至數天的短週期變星候選者，提供作為未來後續其他研究的參考。但經尋找後，並未在該星團中辨認出有亮度變幅明顯的短週期變星，須再尋求影像分析方式是否有需要改進之處。

P-16

Modeling the spatial distribution of neutron star merger remnants in the Milky Way

Heng-Hao Chen (National Tsing-Hua University); Meng-Ru Wu (Institute of Physics, Academia Sinica)

The observation of double neutron star mergers (NSM) via their gravitational wave and electromagnetic emission provide strong evidence that these events play an important role in producing the r-process elements. However, unlike most supernovae taking place near the Galactic plane, the position of NSM and their remnants may locate at high Galactic latitudes due to the imparted NS natal kick. Future detection of the decay γ-ray lines from the NSM remnants in the Milky Way (MW) may therefore provide clues about the formation of double neutron star systems. In this on-going work, we compute the spatial distribution of the NSM merger remnants in the MW by utilizing the open-source code Galpy capable of computing the trajectories of moving bodies under the MW potential. We investigate the dependence of the NSM remnant distribution on the magnitude of the NS natal kick velocity.

P-17

3D simulations of superluminous supernovae

Ke-Jung Chen

A newborn magnetar enclosed in a young supernova is thought to produce a luminous optical transit by tapping most of its spinning-down energy into radiation. Luminosity from the magnetar snowplows its surrounding gas and creates an expanding shell. This shell is subject to fluid instabilities and forms a big density spike that has been found in previous 1D models. Recently, multidimensional simulations suggest that the 1D density spike truncated into fragmentary structures, implying that strong fluid instabilities frequently occur inside magnetar-powered supernovae. We present a high- resolution 3D hydrodynamics simulation in 4pi geometry of a magnetar-powered supernova of a 6 Msun carbon-oxygen star. We find the shell is subject to strong fluid instabilities and that turbulent gas forms inside it. Because an extensive circumstellar medium formed before the star exploded, reverse-shock driven fluid instabilities cause additional mixing from the outer part of the ejecta. These two different mixing mechanisms together break down the spherical symmetry of the supernova ejecta. The resulting mixing of chemical elements are reflected in its spectral observation and polarized features because of the asymmetry of the ejecta.

P-18

Impact of deleptonization on core-collapse supernova multimessenger signals

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The electron capture rates during the collapse of a stellar core dominate the deleptonization and, therefore, describe the bounce shock’s location and energy, which should provide unique multimessenger signals that could be used as a constraint in further observations. In this work, we use a parametrized deleptonization formula to investigate the impact of deleptonization on the explodability and multimessenger signals of core-collapse supernovae via two-dimensional hydrodynamics simulations with neutrino transport.

P-19

Possible Bridge: Radiation Hydrodynamic with Variable Eddington Tensor in Stellar Wind and Shock Breakout

Wun-Yi Chen (NTU, ASIAA);Ken Chen (ASIAA)

Observations and theories need bridges to connect, either from radiation to density distribution or vice versa. From simulations' point of view, radiation transfer is not only important in fitting observations but actually capturing realistic behavior of scattering, absorption, and heating/cooling, which then effect the final results of universe structures. We implement Variable Eddington Tensor developed by ATHENA group to calculate radiation transfer in various environments. We focus on the process where radiation starts to impact CSM or ISM, pre-modeling of molecular cloud to main sequence star/ red supergiant are done by Sung-Han and Po-Sheng using MESA code.

P-20

Searching for Young Stellar Objects through SEDs by Machine Learning Methods

Yi-Lung Chiu (NTHU), Chi-Ting Ho (NTHU), Daw-Wei Wang (NTHU), Shih-Ping Lai (NTHU)

Accurate measurements of statistical properties, such as the star formation rate and the lifetime of young stellar objects (YSOs) in different stages, is essential for constraining star formation theories. However, it is a difficult task to separate galaxies and YSOs based on spectral energy distributions (SEDs) alone, because they contain both thermal emission from stars and dust around them and no reliable theories can be applied to distinguish them. Here we develop a machine learning algorithm based on Convolutional Neural Network, named Spectrum Classifier of Astronomical Objects (SCAO), to classify regular stars, galaxies, and YSOs, solely based on their SEDs. Superior to previous classifiers, SCAO is solely trained by labeled data without a priori theoretical knowledge, and provides excellent results with high precision (>95%) and recall (>98%) for YSOs when data from only eight bands are included. We investigate the effects of observation errors and distance effects, and show that high accuracy performance is still maintained even when using fluxes of only three bands (IRAC 3, IRAC 4, and MIPS 1) in the long wavelengths regime. We apply SCAO to Spitzer Enhanced Imaging Products (SEIP), the most complete catalog of Spitzer observations, and found 136689 YSO candidates. Finally, based on results predicted by SCAO, we provide an intuitive contour plot for a direct identification of YSOs even without any calculation. The website from SCAO is available at http://scao.astr.nthu.edu.tw.

P-21

Searching for Lensing Candidates

Hsiao-Cheng Chou (NCU); Chorng-Yuan Hwang (NCU)

We investigate close binary point sources with similar properties to look for possible lensing objects. We first searched for double point sources that are close to each other with angular separations less than 15 arcsec from Pan-STARRS PS1 catalog. We only selected pair sources that have similar colors that derived from five filters of Pan-STARRS. We then plotted the light curves of these sources to see if there is any correlation in their color and/or magnitude variation. We found some pairs showing simultaneous magnitude variations, which are difficult to explain with simultaneous variations of the properties of these pair sources because of their large physical separations.

P-22

High Frequency Radio Observations of Two Magnetars, 1E1547.0−5408 and PSR J1622−4950

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Albert K. H. Kong (Institute of Astronomy, National Tsing Hua University);
Hsiang-Kuang Chang (Institute of Astronomy, National Tsing Hua University)

We investigated the radio spectra of two magnetars, 1E 1547.0-5408 and PSR J1622-4950, using observations from the Australia Telescope Compact Array and the Atacama Large Millimeter/submillimeter Array taken in 2017. The spectrum of 1E 1547.0-5408 was inverted in the range of 43-95 GHz, suggesting a spectral peak at a few hundred gigahertz. Our observations of PSR J1622-4950 show a steep spectrum with a spectral index of -1.3 in the range of 5.5-45 GHz during its re-activating X-ray outburst in 2017. By comparing the data taken at different epochs, we found significant enhancement in the radio flux density. Moreover, we obtained the X-ray and radio light curves of radio magnetars from literature and found two interesting properties. First, the radio magnetars may have double peak spectra at a few GHz and a few hundred GHz. This could indicate that the emission mechanism is different in the cm and the sub-mm bands. Second, radio emission is known to be associated with X-ray outburst but has different evolution. We further suggest that the rising time of the radio emission is much longer than the X-ray during the outburst. This phenomenon could provide a hint to understand the origin of radio emission and its connection with the X-ray properties.

P-23

ALMA Observations toward the S-shaped Outflow and the Envelope around NGC1333 IRAS4A2

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Shingo Hirano (Kyushu University); Masahiro N. Machida(Kyushu University)

NGC1333 IRAS4A is a well-studied Class 0 protobinary system embedded in a circumbinary envelope. Each protostar of the binary, IRAS4A1 and IRAS4A2, ejects its outflow toward the north and the south. To investigate the system in more detail, we analyzed ALMA archival data of SO (6_5-5_4), SO (7_6-6_5), and CO (2-1) lines. In the last ASROC meeting, we reported the S-shaped outflow driven by IRAS4A2, which consists of a flattened envelope surrounding the central source and two outflow lobes connected to both edges of it. The flattened envelope has an opposite velocity gradient to that of the circumbinary envelope. The S-shaped morphology is obvious in the high velocity range, whereas it is less significant in the low velocity range showing two conical cavities. The observed features are reproduced by the magnetohydrodynamic simulation of the collapsing core whose magnetic field direction is misaligned to the rotational axis. Our simulation shows that the intensity of the outflow lobes is enhanced on one side, resulting in the formation of S-shaped morphology. Here we present the simulation result including the effects of SO abundance and sublimation temperature. The new model can reproduce the S-shape morphology more obvious than the previous one with constant SO abundance. In addition, the new model better reproduce the morphological difference between low and high velocity components, i.e. the S-shaped enhancement is weaker at a low velocity whereas the enhancement is stronger at a high velocity. The opposite velocity gradients in the flattened envelope and the circumbinary envelope can be explained as the rotation and inflowing motion, respectively. Addtionally, we also discovered a previously unknown extremely high velocity component at ±45—70 km/s near IRAS4A2 with CO.

P-24

A Comprehensive, Multi-Wavelength Survey on the Nebula Structures Around Wolf-Rayet Stars in the Large Magellanic Cloud

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Wolf Rayet (WR) stars are evolved massive stars known to produce fast stellar winds between 1000 - 3000 km/s. These winds interact with the ambient medium to form shell structures, which, indeed, have been observed. However, the stellar wind interactions begin as early as the star's Main Sequence stage when fast winds sweep up the interstellar medium (ISM) to form an interstellar bubble (ISB). As the star evolves into a red supergiant (RSG) or luminous blue variable (LBV), it ejects stellar material through slow winds to form a circumstellar nebula. When the star enters the WR stage, the fast stellar wind sweeps up the ambient circumstellar nebula to form a circumstellar bubble (CSB). In order to study the interaction of these structures with the ambient medium, we must first acquire a thorough understanding of the interstellar environment the WR star is in. To date, surveys of WR stars in the Large Magellanic Cloud (LMC) have produced a fairly complete catalog of 154 known stars. With new surveys of neutral and ionized gas and these known WR stars, we are able to conduct a comprehensive, multi-wavelength study of the multi-phase interstellar environment of WR stars for the first time. Specifically, we examined the Magellanic Cloud Emission Line Survey (MCELS) images in the H-alpha, [O III], and [S II] lines, Spitzer IRAC 8 micron images and MIPS 24 micron images, and 4m MOSAIC H-alpha images for the entire LMC. This allows us to examine the WR stars and their associated nebulae more extensively. In this poster we report our methodology and results on the morphology and statistics of the nebular structures of WR stars and their implications on stellar evolution.

P-25

Forbidden Line Emission from Balmer-dominated Supernova Remnants

Chuan-Jui Li 李傳睿 (ASIAA), You-Hua Chu 朱有花 (ASIAA)

Supernova remnants (SNRs) are commonly identified by diffuse X-ray emission, nonthermal radio emission, and strong [S II] λλ6716, 6731 lines, which are characteristics produced by high-velocity shocks. However, some SNRs exhibit optical spectra that are dominated by hydrogen Balmer lines with no or very weak forbidden lines. Such "Balmer-dominated" spectra can be explained by collisionless shocks advancing into a partially neutral medium. Surprisingly, in some Balmer-dominated Type Ia SNRs, forbidden line emission is detected at a significant level. In the cases of Kepler and N103B, bright forbidden-line emission is detected from dense knots in a circumstellar medium (CSM) ejected by the SN progenitor before its explosion, indicating that the progenitor white dwarf must have accreted material from a normal star companion. In this poster, we have used Hubble Space Telescope (HST) Hα images to examine the shell structure and to search for dense nebular knots within five LMC Balmer-dominated Type Ia SNRs: 0509−67.5, 0519−69.0, N103B, DEM L71, and 0548−70.4. We have also used the VLT MUSE and ATT WiFeS observations of these five SNRs to extract continuum-subtracted line images. These superb imaging and spectroscopic data make it possible to discover faint forbidden line emission and resolve dense knots. We discuss the implication of the results on the nature of the SN progenitors and the evolutionary status of the SNRs.

P-26

An analysis of flares of Wolf 359 with EDEN and K2 observations

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Wolf 359, a nearby M5.5 flare star, was observed by the EDEN project which is a global network of one-meter class telescopes for the purpose of identification and characterization of habitable exoplanets within 50 light-years. When compared with the archived K2 data, the flare frequency distribution of Wolf 359 can be extended to flare energies as low as 1028 ergs thus providing uniform information on the magnetic activity of this exoplanet-hosting M dwarf. We found that Wolf 359 has a relatively strong flare activity when compared to flaring M dwarfs in literature. The occurrence rate of flare with Ef >= 1028 ergs is about 5300 times per year. As a comparison, the Sun could produce such flare about 400 times per year in the solar maximum estimated in 2001. We also found that, according to flare activity - rotation period relation, Wolf 359 is in the saturation phase, indicating that its flare related emission (e.g. X-ray, UV flux, H-alpha, etc.) may be saturated as well.

P-27

Time-Resolved Optical Flares of the nearby M Dwarf Wolf 359

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Jinzhong Liu (Xinjing Astronomical Observatory)

We present detection of stellar flares of Wolf 359, an M5.5 dwarf in the solar neighborhood (2.42~pc) known to have active surface magnetic activity. The observations were carried out in 2020 April 23 to 29 by the 1 m telescope (NOWT) at Nanshan of XAO, and with one of the 0.5-m TAOS/BEST telescopes located in Qitai. During effectively about 25 hours of monitoring, a total of 10 optical flares were detected, including a "superflare" occurred on April 26 and was observed by both telescopes, enabling us to check the systematics (different cadences, filters) and any possible details in the flare light curves. The flare frequency by our analysis is consistent with that reported previously in radio, X-ray and optical wavelengths. We discuss the flare parameters of Wolf 359 such as the released energy, time duration in the contexts of active M dwarfs prone to stellar flares.

P-28

Impact of nuclear heating on the mixing of kilonova ejecta

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The multimessenger detection of the kilonova GW170817 from the merger of two neutron stars has revealed clues to the formation of heavy elements than iron. Meanwhile, several interesting questions related to the properties of the radioactively powered ejecta remain. In this project, we parametrize the outflow properties around the merger remnants and investigate the role of feedback from nuclear heating on the outflow of kilonova ejecta relevant to heavy-element nucleosynthesis via long-term axisymmetric hydrodynamic simulations.

P-29

Machine learning & time series analysis on Mira variables: from OGLE to ZTF.

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Chow-Choong Ngeow(Graduate Institute of Astronomy, National Central University)

Nowadays , there are a lot of sky survey datasets with cadence of days, and machine learning is one of the most popular techniques to analyze the data due to its very powerful classification ability. There are several survey projects that we can obtain light curve data for interested variable stars, one of them being Mira variables. Mira variables are asymptotic giant branch pulsating stars that exhibit large cyclical variation spanning 100 to 700 days, but in some extreme cases the variations can go beyond 1500 days. Mira variables can be divided into O-rich and C-rich Miras. We collected 2015 confirmed Miras light curve data in LMC and SMC from OGLE database. Based on the light curves we found Mira can also be divided into regular Miras and multi-periodic Miras. We used python package Feature analysis for time series (FATs) to extract the light curve features, then we used these features to separate out the regular Mira and multi-periodic Mira using machine learning techniques. We found in regular Miras magnitude of maximum light can improve the period-luminosity relation, and we found that regular Miras and multi-period Miras exhibit difference in color index using the OGLE photometric dataset. We also found that light curves of the multi-periodic Miras can be decomposed to a short pulsation period and a long secondary variation. And we collect SED data of regular Mira and multi-period Mira we found they are have different component with their SED. We then applied our results to [HBS 2006] 40671, a confirmed long period Mira found in M33. Using observed light curves from Hartmann et al (2006) data, Barsukova et al. (2011) found a period of 665 day for this Mira. In addition to Hartmann's data (2005~2006), we also collected LOT(Lulin Observatory) data, CRTS (Catalina Real-time Transient Survey) data, ASAS-SN data, PTF (Palomar Transient Factory) and ZTF (Zwicky Transient Facility) data taken from 2009 to 2018. Combining all datasets that spanned ~13 years we can refine the period of this Mira. Based on the combined light curve, we found that this Mira could exhibit a long secondary variation, hence we classified [HBS 2006] 40671 as a multi-periodic Mira.

P-30

Candidates of X-ray-Faint Balmer-Dominated Supernova Remnant in M33

Po-Sheng Ou (ASIAA/NTU); You-Hua Chu (ASIAA); Chuan-Jui Li (ASIAA)

Balmer-dominated optical spectrum is a characteristic of young Type Ia supernova remnants (SNRs). To date, only 10 Balmer-dominated SNRs are known in the Galaxy and the Large Magellanic Cloud (LMC). We intend to search for Balmer-dominated SNRs in M33, the next sizeable galaxy beyond the LMC, to enlarge the sample in order to investigate properties of progenitors and environments of Type Ia SNe. The sample of young Type Ia SNRs in the Galaxy appears to show two distinct types of X-ray properties: the X-ray-bright thermal X-ray sources, such as Kepler and Tycho, and the X-ray-faint nonthermal sources, such as G1.9+0.3 and SN1006. The Balmer-dominated young Type Ia SNRs in the LMC are all X-ray-bright with X-ray luminosities greater than 5x10^35 erg/s. In our first search for Balmer-dominated Type Ia SNRs in M33, we used the criterion L_X > 5x10^35 erg/s, but did not find any convincing candidates in M33 (Lin et al. 2020, ApJ, in press). While this result is puzzling, it also indicates that different galaxies may have different populations of Type Ia SNe. In this work, we have examined all 662 X-ray sources in M33 identified by the ChASeM33 team (Tullmann et al. 2011), searched for their optical counterparts, and compared their H-alpha, [SII] and [OIII] images. We present the optical images of some promising candidates of X-ray-faint Balmer-dominated SNRs, and compare them with the Galactic Type Ia SNRs. If some of the candidates are confirmed in further observations, they will help us understand the populations of young Type Ia SNRs and their relationship with the types of their host galaxies.

P-31

Critical Metallicity of Stellar Mass Loss and Red Supergiant Formation

Po-Sheng Ou (ASIAA/NTU); Ke-Jung Chen (ASIAA); You-Hua Chu (ASIAA)

We present a systematic study of the mass loss of massive stars. Mass loss plays a vital role in the evolution of massive stars, and it is suggested to depend on metallicity. However, the total mass loss during the lifetimes of massive stars with different metallicities is still unclear. In this paper, we use 1D stellar evolution models to understand the physics of mass loss and its dependence on stellar metallicity. We consider different stellar masses and metallicities to build up a grid of ~2000 models. Stellar winds, containing hot main-sequence wind and cool supergiant wind, are the main drivers to the mass loss of massive stars in our models. Our results demonstrate the existence of a critical metallicity Zc at the absolute metallicity Z~10^-3, around which the mass loss shows dramatic behaviors. With a Z>Zc, massive stars tend to evolve into the red supergiants, then trigger a robust cold wind through dust formation. On the other hand, if Z is lower than Zc, massive stars would remain compact and evolve into the blue supergiants, in which cold wind is not active, and the mass loss is generally weak. We also propose a mechanism of red supergiant formation based on our simulations to explain the critical metallicity. We found that the iron opacity bump at the temperature of 30,000 K can trigger the inflation of supergiant envelopes. The lowest metallicity value that can drive the Ledoux instability at the iron opacity bump is defined as the critical metallicity. Besides, we also calculate feedback of mass loss, which yields momentum and energy for a 10^5 Msun star cluster with the Salpeter IMF. Our results provide realistic stellar wind feedback models, which are useful for the galaxy and ISM simulations.

P-32

Monitoring the Variability of 95 GHz Methanol Masers with YTLA

Po-Sheng Ou (ASIAA/NTU); Geoffrey Bower (ASIAA); Kai-Yang Lin (ASIAA)

Methanol masers are often found in high-mass star forming regions. The variability of methanol masers can help understand the pumping mechanism, and also the physical conditions in the star forming regions. While the Class II methanol masers are well known as variating sources, the variability of Class I methanol masers is still uncertain. There is a lack of observations of Class I methanol masers at different times, and a long-term monitoring of these masers can help determine their variability. The frequency range of Yuan-Tseh Lee Array (YTLA) includes the 95 GHz methanol maser line, and thus it is suitable for monitoring the variability of these masers. In this poster, we report the YTLA observations of 95 GHz methanol masers in 2018 to 2020. We continue to monitor some bright maser sources during this period, and also observe some maser sources claimed in the catalog compiled by Yang et al. to compare with their reported fluxes.

P-33

Creating a legacy survey of variable stars in the crowded galactic plane.

Atharva Patil (NCU, Taiwan); Prof. Chow-Choong Ngeow (NCU, Taiwan)

An important science topic at IANCU is studying variable stars. Variable stars have been studied and surveyed for a large part of the sky due to their importance in understanding stellar properties as well as their importance in estimating distances. However, the crowded Galactic Plane has been generally avoided by most surveys in the past. ZTF however has studied the Galactic plane extensively in g, r and i bands. While these wavelengths are suitable for studying a large category of variable stars, we miss out on the blue end of the spectrum like blue large amplitude pulsators, blue stragglers etc. We try to overcome this problem with the help of CFHT u band. The other major problem of the crowded field is also looked upon with a recently developed method of cross matching sources. Here I present the preliminary results obtained by comparing the light curves for selected variable stars with the newly obtained CFHT data and using the new method for resolution of sources.

Hiding Surviving Companions in Type Ia Supernova Remnants

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Recent theoretical and numerical studies of Type Ia supernova explosion within the single-degenerate scenario suggest that non-degenerate companions could survive and the supernova impact could be luminous after the explosion. However, the surviving ex-companions are still not firmly detected in observations of nearby type Ia supernova remnants. In this project, we investigate the response of surviving companions via two-dimensional hydrodynamics simulations of supernova ejecta on binary companions and the subsequent long-term stellar evolution of surviving companions. We consider a wide range of possible hydrogen-rich companions and characterize the companion response systematically. Our results suggest that some of the single degenerate channels would favor low mass ($< 1M_\odot$) companion and close binary separation at the onset of the explosion, to explain the non-detection of surviving companions in nearby supernova remnants.

Generating Kilonova Light Curves Using Recurrent Neural Network/ Autoencoder to Investigate the Properties of a Compact Binary Merging System

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The discovery of the optical counterpart, along with the gravitational waves from GW170817, of the first binary neutron star merger, opened up a new era for multi-messenger astrophysics. The optical counterpart, designated as a kilonova (KN), has immense potential to reveal the nature of compact binary merging systems. Ejecta properties from the merging system provide important information about the total binary mass, the mass ratio, system geometry, and the equation of state of the merging system. In this study, a neural network has been applied to learn the optical light curves of the KN associated with GW170817 using real data and we generate the light curves based on different ejecta properties such as lanthanide fraction, ejecta velocity and ejecta mass. Further, this method will be applied to learn the light curves directly from observations. This will further help to identify the dependency of these properties on the merger system. This current work is amalgamated with neural networks and KN data analysis. It is expected that the obtained results will be insightful towards the investigation of KN light curves and compact binary merger systems. Keywords: Kilonova, neural network, light curve

P-36

Spatially resolving stellar population properties of galaxies across cosmic time with piXedfit

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Despite the recent improvements in spatial resolution of imaging surveys, most photometric studies of galaxies have only been done by treating galaxy as a single point object. On the other hand, the advent of IFU surveys has revolutionized the way we study galaxies. Despite its powerful capabilities, wide-area IFU surveys have only limited to local galaxies. The current improvements in the SED fitting method make it is time to implement the method to pixel scale SED. We are developing piXedfit (pixelized SED fitting) which is a python package that provides everything needed for spatially-resolving stellar population properties of galaxies in the local universe as well as in high redshifts using broad-band imaging data as well as spectrophotometric data. The package provides tools for image processing, pixel binning, and SED fitting. We have tested piXedfit using mock SEDs from Illustris TNG. We are applying this code to galaxies from very nearby up to z~2. In an effort to better infer spatially resolved SFH of local galaxies, we are applying piXedfit to analyze the spatially resolved FUV-NIR spectrophotometric SEDs of local galaxies using IFU data from MaNGA and CALIFA combined with the imaging data from GALEX, SDSS, 2MASS, WISE. In the future, this code can be an essential tool for resolving the stellar properties of galaxies across a wide redshift range in the future era of big data in photometry (from JWST, WFIRST, LSST, and Euclid).

P-37

Testing the existence of linear black hole mass − τ relation for LLAGN

Boyan Chen (NTHU), Geoffrey C. Bower (ASIAA), Jason Dexter (Colorado), Sera Markoff (Amsterdam), Anthony Ridenour (Keck) and Huei-Ru Vivien Chen (NTHU)

A big question for Active Galactic Nuclei (AGN) is whether there is a relation between the accretion and the mass scale of the center black hole, the emission coming from the accretion disk, the outflow and jet cross all the electromagnetic spectrum, therefore the flux variability provide a good probe to investigate the accretion and outflow physics. Previous studies found that there is a relation between power spectrum break time scale and black hole mass and luminosity in X-ray and NIR variability (McHardy et al. 2006 & Meyer et al.2009). In Submillimeter wavelength (230 GHz), Dexter et al. 2014 revealed a characteristic time scale of Sgr A* about 8 hours, which is consistent with the viscous time scale. Bower et al. 2015 investigated 413 sources in SMA calibrator list including different type of AGN and found that there seem to be a linear relationship between black hole mass and τ for low luminosity AGN (LLAGN). To exam this linear relationship for LLAGN, we monitored the light curve of six LLAGNs. For Cen A, combine the SMA calibrator list with our observation, we have the light curve spanned about 13 years. The observation spanned 40 month for M84, NGC4278, NGC4579. We also have the light curve for NGC4552 and NGC4579 which spanned about 12 month. We present the preliminary result of these light curve and the analysis of the characteristic time scale.

P-38

Magnetohydrodynamics Simulations of the First Galaxy Formation

Huai-Hsuan Chiu (ASIAA/NTU), Ke-Jung Chen (ASIAA)

With the modern large telescopes, astronomers can peek into the universe and study its large scale formation. At the kiloparsec scales, the magnetic field plays an important role in the star formation and galaxy evolution. In this poster, we study how the magnetic field influences on star formation with cosmological simulations. To achieve this goal, we use the N-body hydro code GIZMO (Philip F. Hopkins.,2018) to perform the cosmological simulation with 140 million particles including dark matter, gas, and star. The initial conditions of our simulations are generated by the MUSIC(Oliver Hahn and Tom Abel.,2011) code, which takes the cosmological parameters from the WMAP data and use ROCKSTAR (Peter S. Behroozi, 2013) code to search for dark matter halos. We discuss the results and compare them with previous models and provide new predictions for future observatories.

P-39

SCUBA-2 Ultra Deep Imaging EAO Survey (STUDIES): Confusion-limited Submillimeter Galaxy Number Counts at 450 μm

Zhen-Kai Gao (ASIAA/NCU); Chen-Fatt Lim (ASIAA/NTU); Wei-Hao Wang (ASIAA); Chian-Chou Chen (ASIAA)

We present the deepest 450 μm galaxy number counts in the COSMOS-CANDELS field derived from the first nearly confusion-limited SCUBA-2 450 μm map from the SCUBA-2 Ultra Deep Imaging EAO Survey (STUDIES). This confusion-limited map covers 530 arcmin2 in area and achieves a noise level at the map center of about 0.6 mJy. We detected 515 sources at 3.5σ with flux densities ranging from ~2 to ~60 mJy. We derived the raw number counts from the directly extracted sources and performed Monte Carlo simulations to recover the intrinsic number counts. Compared to the counts in the literature, our counts extend to flux densities of ~50% fainter and ~40% brighter. We find that the trend of the faint-end counts is still consistent with that in the literature and no faint-end drop-off or flatten-out were observed. This suggests that there remain abundant faint 450 μm sources unresolved by current SCUBA-2 imaging. The bright-end counts are now better constrained to show a steeper turn. To understand the possible evolution of this population, we also compare our counts with those derived from models. The results show reasonable consistency, although minor disagreements may be present. We will also compare the integrated surface brightness from our counts with that measured by COBE and discuss the implication.

P-40

No redshift evolution of non-repeating fast radio-burst rates

Tetsuya Hashimoto (NTHU); Tomotsugu Goto (NTHU); Alvina Y. L. On (UCL); Ting-Yi Lu (NTHU); Daryl Joe D. Santos (NTHU); Simon C.-C. Ho (NTHU); Seong Jin Kim (NTHU); Ting-Wen Wang (NTHU); Tiger Y.-Y. Hsiao (NTHU)

Fast radio bursts (FRBs) are millisecond transients of unknown origin(s) occurring at cosmological distances. Here we, for the first time, show time-integrated-luminosity functions and volumetric occurrence rates of non-repeating and repeating FRBs against redshift. The time-integrated-luminosity functions of non-repeating FRBs do not show any significant redshift evolution. The volumetric occurrence rates are almost constant during the past ~10 Gyr. The nearly-constant rate is consistent with a flat trend of cosmic stellar-mass density traced by old stellar populations. Our findings indicate that the occurrence rate of non-repeating FRBs follows the stellar-mass evolution of long-living objects with ~Gyr time scales, favouring e.g. white dwarfs, neutron stars, and black holes, as likely progenitors of non-repeating FRBs. In contrast, the occurrence rates of repeating FRBs may increase towards higher redshifts in a similar way to the cosmic star formation-rate density or black hole accretion-rate density if the slope of their luminosity function does not evolve with redshift. Short-living objects with <~ Myr time scales associated with young stellar populations (or their remnants, e.g., supernova remnants, young pulsars, and magnetars) or active galactic nuclei might be favoured as progenitor candidates of repeating FRBs.

P-41

Spectral energy distributions of dust and PAHs based on the evolution of grain size distribution in galaxies

Hiroyuki Hirashita (ASIAA); Weining Deng (NTU); Maria S. Murga (Russian Academy of Sciences)

Evolution of infrared dust emission from galaxies has not been understood in a manner consistent with the dust evolution. In this study, we calculate the evolution of infrared spectral energy distribution (SED), considering silicate, carbonaceous dust, and polycyclic aromatic hydrocarbons (PAHs), using our recently developed evolution model of grain size distribution. The dense gas fraction of the interstellar medium (ISM), the star formation time-scale, and the interstellar radiation field intensity are the main parameters. We find that the SED shape generally has weak mid-infrared (MIR) emission in the early phase of galaxy evolution because the dust abundance is dominated by large grains. At an intermediate stage ($\sim$1 Gyr), the MIR emission grows rapidly because the abundance of small grains increases drastically by the accretion of gas-phase metals. We also compare our results with observational data of nearby and high-redshift ($z\sim 2$) galaxies taken by Spitzer. We broadly reproduce the flux ratios in various bands as a function of metallicity. We find that the ISM dominated by the diffuse phase is favored to reproduce the 8 micron intensity dominated by PAHs both for the nearby and the $z\sim 2$ samples. A long star formation time-scale raises the 8 micron emission to a level consistent with the nearby low-metallicity galaxies. The broad match between the theoretical calculations and the observations supports our understanding of the grain size distribution, but the importance of the diffuse ISM for the PAH emission implies the necessity of spatially resolved treatment for the ISM.

P-42

Unveiling quasar host galaxies and their Lyα emission at z~6 by SHELLQs

Simon C.-C. Ho (NTHU); Tomotsugu Goto (NTHU); Tetsuya Hashimoto (NTHU)

Host galaxies of high redshift quasars (QSOs) are of interest. They provide us with a valuable opportunity to investigate the physics relevant to the starburst-active galactic nuclei (AGN) connection at the earliest epoch of the Universe, with the most luminous black holes. Here we report an optical detection of an extended structure around a stacked QSO image. We have stacked 46 high-z (zmedian = 6.13) QSOs images by Subaru/Hyper Suprime-Cam. These QSOs are mainly identified by the Subaru High-z Exploration of Low-Luminosity Quasars (SHELLQs). We have carefully subtracted a point spread function (PSF) constructed using nearby stars from the images. After the PSF (QSO) subtraction, a structure in the z-band extends for more than 4" on the sky (Re = 11kpc). The stacked host may be a forming giant galaxy, co-evolving with a supermassive black hole. More analysis will be carried out in the future.

P-43

Dark matter distributions in the central regions of nearby spiral galaxies

Cheng-Lin Liao (Department of Physics, National Central University);
Chorng-Yuan Hwang (Graduate Institute of Astronomy, National Central University)

The Flat Rotation Curve Problem of spiral galaxies has remained a mystery in astronomy for more than sixty years. The existing of invisible mass, the so-called dark matter, is an explanation of this problem. According to the predictions of different dark matter candidates, the dark matter density profiles in the central region would vary differently. Another explanation of the Flat Rotation Curve Problem is Modified Newtonian Dynamics (MOND), which suggests that the missing mass problem only occurs in small acceleration regimes. We had investigated the central dark matter distributions in nearby spiral galaxy by using observational data from ALMA and WISE. Our results are that the central dark matter density in our nearby galaxy targets are “cuspy”, which poses a challenge to the conventional MOND theories and gives restrictions to possible dark matter candidates.

P-44

Color gradients in nearby galaxies with the Legacy Survey

Li-Wen Liao (NTHU); Andrew Cooper (NTHU)

Color gradients trace radial variations of age and metallicity in galaxies. They may help to distinguish between different models for how and when stellar mass was assembled in galaxies of a given present day mass and average color. Previous work on the correlation of color gradients with average color and magnitude has focused on early-type galaxies and dense environments. Only a few studies discussed the color gradient in spiral galaxies. To improve our understanding of color gradients across the bulk of the galaxy population, we use photometry from DR8 of the DESI Legacy Imaging Survey (LS), which reaches r ~ 24 over ~14,000 deg2. Here we present a study of g-r and r-z color gradients and their correlations with other galaxy properties for 47,000 bright LS galaxies with SDSS spectra. Consistent with the literature, we find almost all galaxies are redder at the center than in the outskirts, and there is a clear trend for galaxies with redder average g-r colors to have relatively redder cores (steeper gradients). The same trend is seen with increasing absolute magnitude (and stellar mass), but reverses at Mr >~ -21 such that the brightest galaxies have shallower gradients. This could be explained by the mixing of stellar populations in mergers. We compare our results to the predictions of the Illustris TNG-100 simulation.

P-45

Waltz of the Galaxies: Galaxy mergers with different mass

Chi-hong lin (IANCU, ASIAA); Ke-Jung Chen (ASIAA); Chorng-Yuan Hwang (IANCU)

Galaxy merger is a violent interaction among galaxies, which can be used to explain the formation of irregular galaxies. However, humans can not observe the entire process of galaxy merger that takes a few giga of years, so we need to model such processes by using numerical simulations. We use the hydrodynamics simulation code, GIZMO to model the processes of galaxy mergers. These virtual galaxies are constructed in the supercomputer, and their input parameters are based on the observational results, We simulate the mergers of two galaxies of different properties such as size, mass, etc. Our goal is to understand the outcome of galaxy mergers by studying its star formation rates, and gas properties. Our simulations can help to understand the observations of exotic galaxies that are likely formed from the mergers.

P-46

Investigating environmental effects on dark-matter-deficient galaxies in the Sloan Digital Sky Survey

Chih-Teng Ling (NTHU); Tomotsugu Goto (NTHU); Tetsuya Hashimato (NTHU)

Galaxies are hosted by huge dark matter halos in general. In contrast to this consensus, dark matter-deficient galaxies (DMDGs) have been discovered recently. The existence of DMDGs challenges our understanding of galaxy formation, suggesting that DMDGs may be a key to revealing the galaxy formation and the nature of dark matter. While several theories have attempted to solve the puzzle of the origin of DMDGs, the current DMDG sample is too small to test the theories. To overcome this problem, we aim to search for more observational evidence of DMDGs from the Sloan Digital Sky Survey data and constrain their properties. In this work, a DMDG is defined as a galaxy with a higher stellar mass to dynamical mass ratio. We report environmental effects on our DMDG sample in various stellar-mass and redshift ranges. Additionally, opposite populations to the DMDG, i.e., dark matter-rich galaxies, will be discussed in the presentation.

P-47

Size-Mass Relations of Galaxies from Sloan Digital Sky Survey

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Using stellar mass and effective radius, we assess the size-mass relation of around 68,000 galaxies from Sloan Digital Sky Survey Data Release 15. We classify these galaxies with respect to their morphology: spiral and elliptical. Both types of galaxies show different size-mass relation. We compare these relations to the relations of compact objects such as globular clusters and ultra-compact dwarfs. The compact objects lie on the extension of best fit size-mass relation of elliptical galaxies but not of spiral galaxies.

P-48

Radial Acceleration Relation of Elliptical Galaxies in Sloan Digital Sky Survey DR15

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Radial Acceleration Relation (RAR) is a relation between the observed acceleration of a galaxy and the acceleration due to its baryonic matter. RAR has been studied extensively in spiral galaxies. In this contribution, we study RAR of elliptical galaxies. We select data of elliptical galaxies from SDSS DR15 through Galaxy Zoo. Elliptical galaxies are pressure support systems, and we use Jeans equation to study their velocity dispersion in dark matter and Modified Newtonian Dynamics (MOND) paradigms. We obtain the RAR of the sample elliptical galaxies at their effective radius and infer the acceleration scale of MOND using Bekenstein form.

P-49

ALMaQUEST survey: What cause the velocity discrepancy between CO and Hα rotation?

Yung-Chau Su(NTU/ASIAA); Li-Hwai Lin(ASIAA);Hsi-An Pan(MPIA);Bau-Ching Hsieh(ASIAA)

In this study, we compare the CO(J=1-0) and Ha kinematics in nearby galaxies. We investigate 17 rotation-dominated, late-type galaxies selected from the ALMaQUEST survey, which is the combination of ALMA CO(J=1-0) Observations for 46 galaxies selected from the MaNGA IFS sample. We use 3-D Barolo, a 3D tilted ring model, to derive the CO and Ha rotation curves. Our result shows that 65%(11/17) of galaxies among the ALMaQUEST subsample present lower Ha rotation compared to the CO rotation, while the remaining galaxies show consistent CO-Ha rotations. To compare with previous research, we also analyze 17 rotation-dominated, star-forming galaxies from the EDGE-CALIFA survey. By combining these data, Our preliminary result suggests that the existence of non-negligible radial pressure support to ionized gas could explain the systematic velocity discrepancy between CO and Ha rotation. On the other hand, there is tentative evidence suggesting that extraplanar diffuse ionized gas, which has lower rotation velocity, also plays a role in the CO-Ha velocity discrepancy.

P-50

Gravitational Field Flux Mechanism for Structural-Dynamical Relations of Systems near Galactic Scale

Te-Chun Wang (Li-Chih High School)

A modified Newtonian gravity has been proposed for disk galaxies. Firstly, A gravitational field flux conservation and redistribution picture is constructed by generalizing the Integral Gauss's law of gravity at non-relativistic limit. 1/r radius dependence and a galactic thickness dependence of gravitational field and the flat rotation curves are obtained by a Gaussian surface with cylindrical symmetry, where most of the gravitational fluxes are assumed to be distributed asymptotically along the disk plane. Subsequently, a spherical to cylindrical transition of the Gaussian surface symmetry across a critical flux density is shown to give the algebraic M ∝ v^4 baryonic Tully-Fisher relation. The transition implies that the 10^-10 m/s^2 acceleration scale can be alternatively interpreted as a critical field strength where gravitational flux redistribution occurs. The universal structural-dynamical relations such as revealed by the radial acceleration curve from Spitzer Photometry and Accurate Rotation Curves (SPARC) data are mapped to the field flux distribution geometry. The Newtonian dynamics above the critical field of ~10^-10 N/Kg near the bulge of High Surface Brightness Galaxies (HSBGs) can be explained by the spherical distribution of the gravitational flux while the Non-Newtonian behaviors of both the Low Surface Brightness Galaxies and the outskirts of the HSBGs can be attributed to the cylindrical flux distribution below the critical field. Finally, a few questions and answers are discussed including: 1. May the Faber-Jackson relation at the core region of elliptical galaxies be attributed to some similar transition from a "Newtonian core" to the non-Newtonian surrounding baryons across the critical field? 2. Can the spiral patterns of disk galaxies find their natural roots from the one-dimensional flux lines of gravitational field? 3. Can the disk shape redistribution of the gravitational field flux be corresponding to a disk of curved space-time for gravitational lensing modeling? Reference: 14th Asia-Pacific Physics Conference proceedings(2019, to appear), A.1b, "Generalized Integral Gauss's Law of Gravity Formulating Conservation and Redistribution of Gravitational Flux to Interpret Structural-Dynamical Relations of Disk Galaxies"

P-51

ALMA Observations of FRB121102

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Fast radio bursts (FRBs) are millisecond transients of unknown origin(s) occurring at cosmological distances. Since the first discovery of FRB, more than 100 FRBs have been detected. Numerous theoretical models of FRB progenitors have been proposed to date. However, the origin(s) is still unknown. One way to constrain the FRB progenitors is to search for their burst counterparts in different wavelengths at the positions of FRBs. Another way is to investigate stellar populations of galaxies hosting FRBs. In this work, we use ALMA data dedicated to FRB121102, which is the most famous 'repeating' FRB hosted by a dwarf star-forming galaxy at z=0.193. No clear multi-wavelength burst counterpart of this FRB has been reported to date. We report the first ALMA detection of FRB121102 at 90.5 and 104.5 GHz. The detected source is either a burst counterpart or host galaxy. These possibilities will be further discussed in our presentation.

P-52

Distinguishing galaxies and young stellar objects in multi-dimensional magnitude space

Kuan-Hsien Wu (NTHU), Meng-Zhe Yang, Shih-Ping Lai(NTHU)

Distinguishing Galaxies and Young Stellar Objects (YSOs) from a database solely containing magnitudes has been proved to be a difficult task, since the physical composition of both types of objects are similar but with different amount (Harvey et al. 2006). Hsieh & Lai (2013) found that YSOs can stand out from Galaxies in Multi-dimensional Magnitude Space, and thus can be separated straightforwardly. Unfortunately, the computer memory required by the Multi-dimensional Magnitude Space method is too much for a database with 8 photometric bands, so Hsieh & Lai (2013) used two 5-dimensional arrays instead. Here we provide two new methods to distinguish galaxies and YSOs. The first method is based on Hsieh ^ Lai (2013) but use 6-dimensional array instead. The second method is to find the boundary to separate galaxies and YSOs in 6-dimensional magnitude space. We will test whether the method in Hsieh & Lai (2013) is adequate or new method can provide more confidence in distinguishing galaxies and YSOs.

P-53

probing dark matter distributions of dwarf disk galaxies using SDSS MaNGA and 2MASS

Weijing Wu (Graduate Institute of Astronomy, National Central University, Zhongli District, Taoyuan, Taiwan);
Chorng-Yuan Hwang (Graduate Institute of Astronomy, National Central University, Zhongli District, Taoyuan, Taiwan)

Galaxies are known to contain dark matter. In particular, the highest dark matter to baryons ratio is found in dwarf galaxies. In this study, we investigate the dark matter distributions of dwarf galaxies using integral field spectroscopy from SDSS MaNGA. Our targets are dwarf disk galaxies with stellar mass smaller than or equal to 10e9 solar mass. We first obtained 2D maps of stellar velocity and velocity dispersion, and the velocity of ionized hydrogen. We then determined the rotation velocity of the galaxies through its relation with the line-of-sight velocity. Combining the velocity dispersions, we can estimate the dynamical mass of the galaxies. To obtain the dark matter distributions in the galaxies, we also estimate the stellar mass distribution using the K-band data from 2MASS. Preliminary results of dark matter distributions of several disk galaxies are shown.

P-54

Magnetic Fields surrounding Filamentary Molecular Clouds

Hsin-Yu Chen(ASIAA); Mehrnoosh Tahani (Dominion Radio Astrophysical Observatory); Ken Chen(ASIAA)

Magnetic fields pervade the interstellar medium are important in the star formation process. Filamentary molecular clouds are known to be the nurseries of star formation. Therefore, determining the morphology of magnetic fields associated with filamentary molecular clouds will enable us to better understand the role of magnetic fields in star formation. Studies and observations by Tahani et al. 2018 and 2019 showed that a bow-shaped magnetic field morphology can explain the magnetic field observations in the Orion-A molecular cloud. We use MagnetoHydroDynamic simulation code of FLASH to simulate a cylindrical filament to study the co-evolution of the filament and magnetic fields to investigate formation of magnetic field wrapping around it.

P-55

Analysis on the relation between the magnetic field and filamentary structure

Wei-An Chen (National Cheng Kung University); Ya-Wen Tang (ASIAA); Jia-Wei Wang (ASIAA)

It is believed that magnetic (B) fields can guide materials in interstellar clouds to form filamentary structures. Under proper physical conditions, irregular shaped grains can be aligned with B fields and thus produce polarized lights. With the polarization data (polarization projected on the sky) from JCMT and ALMA, we can obtain the orientation of the magnetic field in different scales. I will present the morphologies we identified in different regions of the clouds (e.g. Serpens Main) using dendrogram analysis. In order to study the relation between the morphologies and the B fields, we are developing a methodology to quantify this relation. The pros and cons of various methodologies will be discussed.

P-56

Diffusion Drived by Internal Gravity Wave in the First Hydrostatic Core

Chang-Ming Cheng (National Taiwan Normal University)

In star formation, the first hydrostatic core is the first stable object before protostar formation. It is opaque to thermal radiation. Thus, the contraction is adiabatic at this stage and the temperature in the first core increases until molecular hydrogen dissociation begins at 2000 K. The sublimation temperature of calcium–aluminium-rich inclusion, around 1500 K, is the highest sublimation temperature among the solid matter in the solar system. Many people consider that calcium–aluminium-rich inclusion formed by cooling in the protoplanetary disk. However, before the stage of protoplanetary disk formation, the temperature in first hydrostatic core can reach above 1500 K. If there are some mechanisms to transport matter outwards, the cooling will lead to formation of calcium–aluminium-rich inclusion in outer region at this stage. Convection and diffusion are possible mechanisms to transport matter outwards but our calculation showed that the first hydrostatic core is stable against convection. Thus, diffusion is the only possible mechanism. We postulate that the accretion process at this stage results in internal gravity waves which are caused by density gradient and we expect that these waves drive diffusion. In order to describe diffusion, we want to calculate the diffusion coefficient by relating to the wave amplitude. Our goal is to build a model to describe the diffusion process within the first hydrostatic core.

P-57

N2H+ Line Observation by Yuan-Tseh Lee Array

Wen-Tse Chien (ASIAA); Geoffrey Bower (ASIAA); Kai-Yang Lin (ASIAA)

Yuan-Tseh Lee Array (YTLA) observes the 3D power spectrum of molecular gas (CO) by the intensity mapping. Although the requirement of the spectral resolution is about 50MHz, the instrument has a higher resolution at 2MHz. YTLA is good at continuum level observation; however, it lacked the experience in molecular line observation. Molecular lines are important tracers for interstellar medium and star formation. To test and improve the line observation, we observed N2H+ J=1-0 in four high-mass star-forming regions in the Milky Way. To decrease the thermal noise of the deep integration, we maintained a fixed u-v pattern during observations. Nevertheless, the strategy caused a larger pointing offset (1.67 arcmins in average). We considered the primary beam attenuation and did the correction. The improvement of our correction for the flux loss is up to 27.1%. On the other hand, YTLA's deformation by gravity causes the phase error in baselines. The estimation of the loss by the phase error is 15.3%. Besides, YTLA's line observation error is two times larger than the thermal noise. There are other unknown system uncertainties in line observation. The uncertainties caused an extra 22.7% error. For YTLA's line observation, we need more verification and change the observing strategy in the future.

P-58

The JCMT BISTRO Survey: Magnetic Fields Associated with a Network of Filaments in Massive Star-forming Region Onsala 2

Hao-Yuan Duan (NTHU); Shih-Ping Lai (NTHU)

We present new observations of the Massive Star-forming Region Onsala 2 in Cygnus from the James Clerk Maxwell Telescope B-Fields In Star-forming Region Observations (BISTRO) survey with the POL-2 instrument. The BISTRO data cover the entire Onsala 2 complex (∼ 5 pc × 5 pc) at 0.12 pc resolution and spatially resolve the polarized emission from individual filamentary structures for the first time. We aim to clarify the relationship between filaments and B-fields over the whole star-forming area.

P-59

Investigating effects of magnetic fields on gas kinematics in protostellar sources

Aashish Gupta (National Central University, Academia Sinica); Hsi-Wei Yen (Academia Sinica)

Theoretically the magnetic field in molecular clouds is considered to be dynamically important in star formation but observationally it remains unclear as to how efficiently the magnetic field can affect the star formation processes. If the magnetic field indeed plays a significant role, we expect to observe correlations between magnetic fields and gas kinematics. For a sample of protostars, we analyzed motion of gas using molecular-line data obtained with the Submillimeter Array (SMA) and the magnetic field structures using polarimetric data obtained with the James Clerk Maxwell Telescope (JCMT). We statistically investigated the effects of the magnetic fields on gas kinematics.

P-60

ALMA Survey of Orion PGCCs (ALMASOP): Discovery of the prestellar core on the verge of star formation

Naomi Hirano (ASIAA); Sheng-Yuan Liu (ASIAA); Tie Liu (SHAO); Chin-Fei Lee (ASIAA); Sienny Shang (ASIAA); Dipen Sahu (ASIAA); Somnath Dutta (ASIAA); Anthony Moraghan (ASIAA); Kai-Syun Jhan (NTU/ASIAA); Shi-Ying Hsu (NTU/ASIAA); Kee-Tae Kim (KASI); Ken'ichi Tatematsu (NRO); Gwanjeong Kim (NRO)

The ALMA Survey of Orion PGCCs (ALMASOP) project observed 72 dense cores including 23 starless cores and 49 protostellar cores in the Orion molecular cloud complex at 1.3 mm. In this presentation, we report the discovery of the dense and compact "nucleus" in the starless core G208.68-19.02-N2 (G208-N2) in the Orion Molecular Cloud 3 (OMC-3). The 1.3 mm continuum emission from G208-N2 shows a narrow filamentary structure with a size of 12" (4,700 au) x 1.5" (590 au) and a mean density of ~8 x 10^7 cm-3. In the middle of this filamentary structure , there is a compact "nucleus" having a size of 1.48" (570 au) x 0.89" (350 au). The nucleus has a mass of ~0.6 M_sun and a mean density of 6 x 10^9 cm if T_dust is assumed to be 6.5 K. There is no signature of outflow in the CO and H2CO images. The C18O emission is completely absent in the entire region of G208-N2. There is no C18O emission localized to the nucleus. The N2D+, the spatial distribution of which is similar to that of the 1.3 mm continuum, also shows the local minimum at the nucleus. These results imply that the dense gas in this nucleus is still cold, where both CO and N2 deplete onto dust grain. It is likely that the nucleus of G208-N2 is still prestellar, probably in the evolutionary stage on the verge of star formation.

P-61

Chronology of Episodic Accretion in Protostars - an ALMA survey of the CO and H2O snow lines

Tien-Hao Hsieh (ASIAA), Nadia Murillo (RIKEN), Arnaud Belloche (MPIfR), Naomi Hirano (ASIAA), Catherine Walsh (University of Leeds), Ewine F. van Dishoeck (Leiden), Jes K. Jørgensen (Niels Bohr Institute), Shih-Ping Lai (NTHU)

We present our ALMA survey in N2H+ and HCO+ toward 39 Class 0 and Class I sources in the Perseus molecular cloud. The unbiased survey with the large sample is used to reveal the evolution of episodic accretion from the Class 0 to Class I stage in a statistical way. N2H+ and HCO+ are destroyed via gas-phase reactions with CO and H2O, respectively, and are thus used to trace the CO and H2O snowline locations. If the snowline location is at a much larger radius than that expected from the current luminosity, then a past accretion burst has likely occurred that has shifted the snowline outward. Since H2O and CO have different freeze-out times, i.e. 1,000 yr for H2O and 10,000 yr for CO, this difference allows us to estimate the time from the previous burst. We identify 8, 16, and 1 sources have experienced an accretion burst in the past <1000 yr, 1000−10,000 yr, and >10,000 yr, respectively. Statistically, we estimate the interval of ∼2400 yr in Class 0 sources and ∼8,000 yr in Class I sources. This result suggests that at an earlier evolutionary stage, either disk fragmentation occurs more frequently or the fragments tend to fall more often onto the central source, triggering accretion bursts more frequently. The mass accretion rate during the burst estimated from the accretion luminosity is ∼ (1.8−4.2)×10^5 Msun/yr, which shows no obvious variation from Class 0 to Class I.

P-62

Characterization of filaments in the infrared dark cloud SDC13

Han-Tsung Lee(Department of Physics, National Central University) , Ya-Wen Tang(ASIAA) , Jia-Wei Wang(ASIAA)

Filaments play a key role in star formation as dense cores, the star progenitors, are observed to form within them. In this work, we study the filament structure of the infrared dark cloud (IRDC) SDC13 using JCMT POL-2 data at wavelengths of 850 μm. Cores in the filaments are identified by dendrogram method and their physical properties are derived. In addition , we determine the filament structure using DisPerSE algorithm and investigate magnetic field and gravitational force in the region. Then , we analyze their relation with orientation of filaments and cores and discuss the possible origin of the variation along the SDC 13 filament.

P-63

Collapse and Stability Analysis of Sheet-like Structures in the Molecular Cloud

Meng-Hsien Shen (NTNU); Yueh-Ning Lee (NTNU)

Star formation occurs inside over-dense regions in molecular clouds. In recent years, observations have found filamentary structures in molecular clouds, which are highly associated with the prestellar cores. Observation of the Monocerous R2 region (Mon R2) suggests a sheet-like structure and shows a structure with several filaments converging into the central hub. We study the dynamics of this sheet-like structure and its evolution with a physical model. We consider the radial collapse of a sheet under self-gravity and solve the self-similar solutions. We reproduced surface density and velocity profiles which are compatible with observations of Mon R2. Finally, we study the development of filaments in this structure using perturbative analysis, with the goal to obtain the characteristic number of filaments and the line mass of each filament.

P-64

Protoplanetary disk assemblage and evolution revisited with effects of non-ideal magneto-hydrodynamics

Yueh-Ning Lee (NTNU); Sébastien Charnoz (IPGP); Patrick Hennebelle (CEA Saclay)

It is now commonly accepted that the formation and processing of the building blocks of our Solar System, i.e., rocky materials, water ice, and carbon complex compounds, might have occurred, earlier than what was thought before, during the initial collapse of the prestellar core and the formation of the protoplanetary disk. Quite few existing works take into account the building phase of the protoplanetary disk when studying the formation and transport of refractory materials. Due to the complexity of this problem, a simplified hydrodynamic model has long been a convenient choice. We are now studying the self-consistent formation of the protoplanetary disks starting from the collapse that takes into account the environmental effects and large scale physics, including non-ideal magneto-hydrodynamic (MHD) effects that are relatively important at the disk scale, while not taken into account by many existing disk-formation models. With the help of numerical simulations that allow to follow the complex non-linear physics, we try to provide a working recipe for studies of the disk dynamics, thermal evolution of different gas and dust species, and their changes in chemical composition. I will address the properties of the disk formed in our numerical simulations, and compare the measured disk source function to the classical hydrodynamic model.

P-65

The Thickness of Molecular Cloud

Ting-Xuan Li (NTNU); Yueh-Ning Lee (NTNU)

Star formation occurs inside molecular clouds, and these latter usually show complicated structures. In particular, observation of Monoceroos R2 suggests that it is a sheet-like structure. Hence, we want to study this region. However, we can only derive integrated properties from observations, that is, the surface density. Therefore, we try to model the "thickness" of the cloud. We look for hydrostatic equilibrium under various conditions: whether the gravity is dominated by the local surface density or the central mass, whether the pressure support is provided by thermal motion or turbulent velocity dispersion. Once the thickness is known, we can also evaluate the characteristic density of this region.

P-66

The Scale of Self-gravity of Molecular Clouds

Hung-Lin Liao(Department of Earth Science, NTNU); Yueh-Ning Lee(Department of Earth Science, NTNU)

The density probability density function (PDF) is a widely used tool to investigate the structures of molecular clouds and the underlying physics. Simulations and analytical models have suggested that the hierarchical structures, resulting from turbulent motion, produce a lognormal PDF with a power-law tail at high density due to self-gravity. The aim of this project is to find out the characteristic scale of gravitational collapse. Using the dendrogram, we identify the dense, gravitationally collapsing substructures in molecular clouds. Then we average the density of every substructure to filter out the gravitational contribution. We vary the leaf size of dendrogram i.e., the size of substructure, to detect the characteristic scale. We apply this approach on both column density PDF and density PDF to analyze the effect of self-gravity on density structure of molecular clouds and star formation process.

P-67

Magnetically self-regulated formation of discs

Yu-hsuan Liu (National Taiwan Normal University)Yueh-Ning Lee (National Taiwan Normal University)

It is widely accepted that stars form within dense regions of moleculars clouds, under the influence of self-gravity. Due to the conservation of anguler momenentum, the collapse move with the Keplerian rotation (0.1pc~100AU). However, most Prestellar cores are magnetized. If an ideal magnetohydrodynamic (MHD) model is used to describe this collapse, a magnetic field will prevent the formation of disk due to angular momentum transport. However, if non-ideal MHD processes, that is, ambipolar diffusion, Ohmic effect, and hall effect, are taken into account, the magnetic braking will be reduced. We hope to explore the Hall effect model and try to derive the theoretical disc size. We further discuss the bimodel disc size caused by the angular momentum being parallel and anti-parallel to the magnetic field.

P-68

Population III star formation within turbulent primordial gas

Ching-Yao Tang(NTU); Ke-Jung Chen(ASIAA)

The first stars (Pop III stars) play a paramount role in the early universe. Therefore, understanding the physical processes of their formation is essential to studying the early universe’s evolution. Previous cosmological simulations have suggested that the typical mass scale of the Pop III stars are around 100 - 1000 solar masses. However, this result is inconsistent with the recent observations of the extremely metal-poor stars (EMP stars) which infer they should be around 20 - 60 solar masses. This mass deviations can be due to the lack of the subtle hydrodynamic structures of the driven turbulence during the Pop III star formation. To validate the effect of turbulence, we employ the adaptive mesh refinement (AMR) code Enzo and the stochastic forcing model to simulate the accretion of the primordial gas in a mini-halo, which is full of the turbulent gas. Then the inhomogeneous gas density driven by turbulence evolves to form stars. Our simulations have included all the relevant physics of Pop III star formation, such as primordial gas cooling, star formation with sink particles, and feedback from stellar radiation. Finally, we investigate the strength of turbulence on the Pop III star formation and compare our results with the observation of EMP stars.

P-69

On the fragmentation in dense cores

Ya-Wen Tang (ASIAA)

Our recent analysis of the G34 IRDC (Tang et al. 2019) reports a significantly different relative importance between the gravity, magnetic field and turbulence for three cores that show clearly different fragmentation structures. With the ongoing ALMA large program ALMAGAL, we will observe 1000 cores with both 3" and 0.2" angular resolution. In this talk, I will report the status of ALMAGAL and the science goal which we will lead: "the correlation between the magnetic field at filament scale orientation and the distribution (including fragmentation level) of cores."

P-70

The kinematics of the infalling envelope around HH111: Does magnetic braking steal angular momentum in a protostellar system?

Yi-Shan Tsai (ASIAA/NTU); Chin-Fei Lee (ASIAA)

How angular momentum is lost from a system in the core-collapse and disk formation process has been a long-standing problem in star formation. In order to investigate how angular momentum varies in an envelope surrounding a forming star, we explore the kinematics of HH111, a Class I protostellar system. Here we present the observations of HH111 system at ~0."2 resolution(80AU) in C18O(J=2-1) and SO(NJ=6(5)-5(4)) with Atacama Large Millimeter Submillimeter Array. The observations show a flattened envelope with constant specific angular momentum outside, a transition zone, and a compact Keplerian rotating disk innermost. Furthermore, we use radiation transfer code to reproduce the PV-diagrams of HH111 system under various circumstances(e.g., different angular momentum, infalling velocity and total energy). By comparing the results from radiation transfer code and the observations, we discuss about if there is really magnetic braking in the system and how angular momentum influences the kinematics of an envelope and also the formation of a Keplerian disk.

P-71

Small- and large-scale dynamos as the first astrophysics case for GPU API Astaroth

Miikka Väisälä (ASIAA); Johannes Pekkilä (Aalto University);
Maarit Käpylä (Aalto University, Max Planck Institute for Solar System Research, Nordita);
Matthias Rheinhardt (Aalto University); Hsien Shang (ASIAA); Ruben Krasnopolsky (ASIAA)

Astaroth is an application programming interface (API) developed for computing high-order 3d stencil operations, such as finite difference derivatives, using graphics processing units (GPUs). It was originally developed for performing magnetohydrodynamics (MHD) computations, although in its current state it can be adapted for any general purpose where 3d stencils are needed. The properties of the Astaroth API can be generalized for the given task via its Domain Specific Language (DSL). Astaroth is able to compute the high-order operations efficiently with methods inspired by vertex pipelining approach utilized in computer graphics, and we have benchmarked more than 30 times speedup in comparison to a reference code on a CPU node. To prepare the code for widespread astrophysical use, we explored isothermal resistive MHD turbulence, where turbulence was driven by a forcing function. We induced both small- and large scale dynamos by utilizing both helical and non-helical turbulence driving. To test for convergence we used multiple resolutions for each parameter (driving mode of turbulence and resistivity/viscosity), getting results for multiple Reynolds numbers. Our primary focus was the dynamo growth. As a function of growing Reynolds number, helical and non-helical forced systems have two separate branches of growth rates corresponding to large- and small-scale dynamos. However, the growth rates approach each other at high Reynolds numbers, which indicates that the small-scale dynamo is dominating the initial growth. Small-scale dynamo growth rates change as a function of Reynolds number in logarithmic fashion. Our results show that it is not straightforward to separate small- and large scale dynamos from each other during the dynamo growth stages. Based on the analysis of their power spectra and magnetic field distributions over time, there are signatures of a small-scale dynamo even at intermediate Reynolds numbers before a large-scale dynamo emerges.

P-72

Dust trapping and feedback in the protoplanetary disk around HD142527

Hsi-Wei Yen (ASIAA); Pin-Gao Gu (ASIAA)

Growth of dust grains to larger aggregates and further to planetesimals is an important step in the standard core accretion scenario of planet formation. In this presentation, I will introduce our recent study on the mechanisms of dust concentration, which may enhance grain growth, in the protoplanetary disk around a pre-main sequence star HD142527. We analyzed the ALMA archival data of the continuum at six wavelengths from 3 to 0.4 mm and the CO isotopologue lines at multiple transitions to estimate the dust and gas density and thus gas-to-dust mass ratio in the HD142527 disk. In addition, we analyzed the disk rotation traced by the molecular lines and identified a region with non-Keplerian rotation, suggestive of a local pressure bump. We found that this region with non-Keplerian rotation has a higher dust density and a lower gas-to-dust mass ratio compared to the mean values in the disk. I will discuss these results in the context of dust trapping and feedback in the pressure bump in the HD142527.

P-73

Identification of AKARI sources by deep HSC Survey - New Band-Merged Catalog on the NEPW field

Seong-Jin KIM (NTHU); Nagisa OI (Tokyo University of Science, Japan); Tomo Goto (NTHU); Hiroyuki Ikeda (NAOJ); Simon Ho (NTHU); Hyunjin Shim (KNU, Korea); Yoshiki Toba (Kyoto University, Japan); Ho Seong Hwang (KASI); Tetsuya Hashimoto (NTHU); the NEPW collaboration, et al.

The north ecliptic pole (NEP) field has been targeted long since it was surveyed by the AKARI space telescope with its unique wavelength coverage from the near- to mid-infrared (mid-IR). Many follow-up observations have been carried out and made this field one of the most frequently observed areas with a variety of facilities, accumulating abundant panchromatic data from X-ray to radio wavelengths. In this talk, we report the current status: a release of a new band-merged catalog with the multi-band photometry for 91,861 AKARI sources over the NEPW field - all available data from GALEX UV to the sub-millimeter (sub-mm) bands (e.g., Herschel/SPIRE, JCMT/SCUBA-2). Based on the deep optical survey with the Hyper Suprime-Cam (HSC) recently done over this NEP-Wide (NEPW) field, we identified faint sources (~20,000) in the near- and mid-IR bands, which improved the photometric redshift accuracy. This catalog motivates a variety of current researches and will be more useful when we ring in the new era of the NEP region, where the recently launched (eROSITA/ART-XC) and future space missions (such as JWST, Euclid, SPHEREx, and SPICA) are planning to take deep observations.

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A Robotic Telescope System for Cosmic Transients

Kwan-Lok Li (NCKU); Albert K. H. Kong (NTHU)

RIFT is the abbreviation of Robotic Imagers For Transients, which will be the first robotic telescope dedicated to the study of multi-messenger transients in Taiwan. The project has been approved by MOST and will be funded through the Young Scholar Fellowship Program from 2020. In the poster, I will show you the basic configuration of RIFT and the science that RIFT can do.

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Efficient image visualization with CARTA - live demos

Kuo-Song Wang (ACDC, ASIAA) and the CARTA development team

Image cubes obtained from modern telescopes, such as ALMA, VLA, MeerKAT and ASKAP, are getting larger and larger so that existing tools might not be able to provide fluent user experience. The CARTA development project is specifically designed to solve this issue and to provide scalability for future telescopes, such as SKA, ngVLA, and JWST, etc. In this live demo, I will provide brief introduction of the CARTA project and perform live demos on how users might use CARTA for research work.

Dark energy constrained from fast radio bursts without redshift

Tiger Yu Yang Hsiao (National Tsing Hua University); Tomotsugu Goto (National Tsing Hua University), Tetsuya Hashimoto (National Tsing Hua University)

Dark energy are mysterious and still remain unknown. Here we investigated the parameters of hubble constant and dark energy by fast radio bursts (FRBs) which are new emerging transient in the universe. However, redshift of FRBs still need to identify counterpart. Adopting the detection ability of Square Kilometre Array, we generated the FRBs data using Luminosity-duration relation (Hashimoto relation) and propose the cross-correlation method between spatial distribution of the galaxies data with known redshift and the FRBs without redshift measurement. Moreover, we discussed two population of FRBs: repeating and non-repeating FRBs in the mock data. We show that once we measure the observed fluence and intrinsic duration of FRBs, the dark energy can therefore be constrained.

Geometry effects on dust attenuation curves with different grain sources at high redshift

Yen-Hsing Lin (NTHU/ASIAA); Hiroyuki Hirashita (ASIAA)

Dust has been detected in high redshift ($z>5$) galaxies but the origin of dust is still being debated. Previous studies have shown possible dust sources and they would predict different grain size distributions, corresponding to vastly different extinction curves. In this paper, we investigate how the dust attenuation curves predicted by the above extinction curves could be modulated by various radiation transfer effects using two representative dust-star distribution geometries. We confirmed that the steepening and flattening effects drastically modify the attenuation curves. We could reproduce similar attenuation curves even with very different extinction curves. Thus, we conclude that it is difficult to distinguish the dust sources only with the attenuation curves. However, if we include information on dust emission and construct the IRX-beta diagram, a wider area, especially high-beta and low-IRX region covered by the observational data is more easily explained if dust sources are dominated by dust growth.

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Cosmic reionization investigated with Subaru High-z Exploration of Low-Luminosity Quasars

Ting-Yi Lu (NTHU), Tomotsugu Goto (NTHU), Tetsuya Hashimoto (NTHU), Daryl Joe D. Santos (NTHU), Seong Jin Kim (NTHU), Alvina Y. L. On (UCL), Yoshiki Matsuoka (Ehime U.), Toru Nagao (Ehime U.), and the SHELLQs team

It is crucial to observationally constrain the ionization history of the intergalactic medium (IGM) during the epoch of reionization (EoR) because it is strongly connected to the structure formation history and the emission mechanisms of ionizing sources. However, such an important topic has yet to be resolved due to the limited sample size at high redshifts. Quasars (QSOs) at z>6 are one of the best probes of the IGM ionization state during the EoR because they are luminous enough to be detected. Nevertheless, only ~100 luminous QSOs at z>6 are found over twenty years of surveys. A majority of theoretical works on EoR made use of constraints from this small QSOs sample such as the IGM neutral fraction and the HI photoionization rate. Furthermore, the current bright QSO sample may be biased towards overdense regions, which may potentially result in misleading values of the IGM neutral fraction. To overcome these problems, we use the Subaru High-z Exploration of Low-Luminosity Quasars (SHELLQs), which allows the sample to be extended towards fainter (less biased) QSOs with better statistics. With 93 faint SHELLQs QSOs at z>5.5, we present the latest observational constraints on the HI photoionization rate, neutral fraction, opacity fluctuation of IGM, and the redshift evolution of the QSO HII regions.

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Diffuse Lyman α emission in IllustrisTNG

Sung-Han Tsai (NTU/ASIAA); Ke-Jung Chen (ASIAA); Aaron Smith (MIT); Yi-Kuan Chiang (MIT)

The standard cosmological model (ΛCDM) predicts the existence of the cosmic web which composed of interconnecting galaxies and gases stretched out across the universe. However, due to the low-density gas , stars can not form inside this filamentary structure of cosmic web and lead to the difficult and elusive of observation. Theoretically, those filaments can emit the Lyα photons but if the only source of ionizing radiation is UV background, it is still too faint to directly observe. In our work, we use the cutting-edge cosmological simulation data, IllustrisTNG, to calculate the Lyα emission in the universe and compare it with recent observations. We also construct an all-sky distribution of Lyα intensity mapping to explore the structure of the cosmic web.

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Centaurus A Observation with the Compton Spectrometer and Imager

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The Compton Spectrometer and Imager (COSI) is a balloon-borne, soft gamma-ray imager, spectrometer, and polarimeter with sensitivity from 0.2 to 5 MeV[1]. COSI had a successful 46-day flight, launched from Wanaka, New Zealand, in May 2016. Centaurus A, one of the closest AGN from the Earth, was observed by COSI with about 408 ksec useful exposure time in soft γ-rays, which is the least explored regime throughout the whole electromagnetic band for this well-studied source. Since observation is severely background-dominated for a balloon-borne γ-ray telescope, the method of analysis is not straight forward. We employed a method to ensure uniform exposure in the sky area of interest.[2] We conclude that, depending on event selection criteria, Cen A requires 5~8 times more exposure time than COSI had in its 2016 balloon flight to have a 3sigma detection.

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Performance of Observing Gamma-Ray Polarization using CubeSat

Yun-Hsin Chung (NTHU), Tzu-Hsiang Su (NTHU), Chien-Ying Yang (NTHU), Yi-Chi Chang (NTHU), Che-Yen Chu (NTHU), Jr-Yue Hsiang (NTHU), Jeng-Lun Chiu (NSPO), Chic-Hsun Lin (AS). Philippe Laurent (CEA/DRF/IRFU/DAp, Saclay, France), Jerome Rodriguez (CEA/DRF/IRFU/DAp, Saclay, France), and Hsiang-Kuang Chang (NTHU)

Compton polarimeter (Compol) is an instrument onboard a 3U CubeSat dedicated to measuring the polarization of gamma-ray sources. Here, we discuss the performance of the instrument in gamma-ray burst (GRB) polarization measurements based on two layers of 3 mm x 3 mm x 6 mm gadolinium aluminum gallium garnet (GAGG) scintillator, with each layers being a 16 x 16 array (Model 2-1, Yang et al. 2020). Using Monte-Carlo simulations with Megalib toolkit, we can determine the minimum detectable polarization (MDP) of our detector. The MDP of the model will be presented in this poster, and the MDP of another model with different designs will be presented in Su’s poster. More characteristics (i.e. efficiency) will be discussed in Hsiang’s oral.

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A timing study of the 2018/19 outbursts of MAXI J1820+070

Holger Stiele (NTHU), Albert Kong (NTHU)

We present a detailed timing study of the bright black hole X-ray transient MAXI J1820+070 (ASASSN-18ey), based on Swift and NICER observations obtained between March 2018 and October 2019. We computed the fundamental diagrams commonly used to study black hole transients, and studied the evolution of timing parameters. The light curves clearly show four outbursts. The observed properties are consistent with a bright black hole X-ray binary that evolves from the low-hard-state to the high-soft state and back to the low-hard-state and shows two reflares, where it remains in the hard state. In many observations the power density spectra showed type-C quasi-periodic oscillations with a characteristic frequencies below 1 Hz. This finding suggests that the source stayed in a state of low effective accretion for large parts of its outburst. The absence of other types of quasi-periodic oscillations hinders a precise determination of the state transitions, but from combining NICER and Swift/XRT data, we find that MAXI J1820+070 went from the hard-intermediate to the soft state in less than one day. In addition, we present the results of our study of covariance spectra and of multi-waveband studies based on Swift/UVOT data, and discuss implications.

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Performance of Observing Gamma-Ray Polarization using CubeSat

Tzu-Hsiang Su (NTHU), Yun-Hsin Chung (NTHU), Chien-Ying Yang (NTHU), Yi-Chi Chang (NTHU), Che-Yen Chu (NTHU), Jr-Yue Hsiang (NTHU), Jeng-Lun Chiu (NSPO), Chic-Hsun Lin (AS). Philippe Laurent (CEA/DRF/IRFU/DAp, Saclay, France), Jerome Rodriguez (CEA/DRF/IRFU/DAp, Saclay, France), and Hsiang-Kuang Chang (NTHU)

Compton polarimeter (Compol) is an instrument onboard a 3U CubeSat dedicated to measuring the polarization of gamma-ray sources. Here, we discuss the performance of the instrument pin gamma-ray burst (GRB) polarization measurements based on one layer of 3 mm x 3 mm x 6 mm gadolinium aluminum gallium garnet (GAGG) scintillator, with each layer being a 16 x 16 array. Additionally, four layers of double-sided silicon strip detectors (DSSDs) sit on top of the scintillator (Model 1-2, Yang et al. 2020). Using Monte-Carlo simulations with Megalib toolkit, we can determine the minimum detectable polarization (MDP) of our detector. The MDP of the model will be presented in this poster, and the MDP of another model with different designs will be presented in Chung's poster. For other characteristics (i.e. efficiency), it is discussed in Hsiang's oral

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探討民眾選擇觀賞劇場關鍵因子

趙瑞青

宇宙劇場與立體劇場放映影片目前皆以天文、科學、環境生態或教育等主題相關為首選。立體劇場須配戴立體偏光紙眼鏡，利用視差進而產生景深達到立體的效果；而宇宙劇場中 25 公尺半球型螢幕，讓人不需配戴任何眼鏡便能產生逼真的立體效果。 近年來，宇宙劇場與立體劇場的觀看人數呈現明顯的落差，宇宙劇場的佔席率始終大於立體劇場，撇除兩個劇場容納座位數的差異外，期望了解民眾選擇觀賞劇場的關鍵因子。本研究將利用問卷調查及焦點訪談方式，了解民眾來館參觀時，選擇觀賞劇場的關鍵因子為何，以及是否有明顯影片種類偏好，藉以作為未來兩個劇場選片時的參考因素。

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A Jigsaw Approach to Engage Students in Learning Classical Problems of Astronomy

Albert Kong (Institute of Astronomy, National Tsing Hua University)

In modern astronomy, there are several major scientific debates concerning distance scale of several classes of astronomical objects (in other words, the distance to the object). Although these debates are settled now, they provide us valuable reviews of the development of astronomy of the 20th century and good examples how to present scientific arguments to convince others. In my graduate course “Galactic Astronomy”, majority of the content is lecture based. In the past, I only present the outcomes of the debates because these problems were already solved and we treat these as common sense. However, I found that the arguments of both sides are intriguing and carry a lot of fundamental knowledge. They are perfect case studies for graduate students to learn critical thinking and research methods.