2025 天文年會 (ASROC Annual Meeting)

Friday, May 16, 2025 - Sunday, May 18, 2025

College of Management, National Formosa University 國立虎尾科技大學第三校區文理暨管理大樓

中華民國天文學會
The Astronomical Society of the Republic of China (Taiwan)

Report of Abstracts

Poster-EA - Board: 46 / **155**

A Discussion on C0-Scaling of Space and Time of Gravitational Contraction to Intepret the Cosmological Red-Shift

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Discussions are made on an alternative interpretation for the Hubble constant of red-shift. The expansion of the space is relaxed to a relative scaling between the space and the matter with gravity. The possible mechanism and results including the energy difference between space and matterd are discussed.

Section:

Cosmology

Poster-Stars - Board: 18 / **173**

A Photometric Approach to Transient Classification: Insights from DESI and Sky Survey Data

Author: Yu-Hsing Lee[1]

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With the rapid development of sky survey projects and observational technology, over 20,000 transient celestial objects have been discovered annually in recent years. However, due to limited telescope time and observational resources, only about 10% of these transients have been classified through spectroscopic analysis, leaving the physical nature of most objects is unknown. Recently, the Dark Energy Spectroscopic Instrument (DESI) has released extensive spectral data for numerous galaxies, offering valuable resources and opportunities for further analysis. This enables us to perform cross-matching between unclassified transient objects and DESI data based on celestial coordinates, facilitating the identification of potential host galaxies. By cross-matching DESI spectroscopic redshift data with images from sky survey projects, we calculate the absolute magnitudes of transient objects using the redshift of their host galaxies and their observed peak brightness, thereby achieving preliminary photometric classification. Furthermore, we conduct in-depth analysis of transient objects with extreme luminosities, including exceptionally bright (M < -19.5) and faint (M > -14) cases. This study explores the potential origins and physical implications of these unusual transients, laying important groundwork for future research.

Section:

Stars/Star Clusters

Poster-EA - Board: 31 / **43**

A TESS Full-Sky Map for Low Surface Brightness Astronomy

Authors: Po-Han Chen[1]; Yi-Kuan Chiang[1]

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The Transiting Exoplanet Survey Satellite (TESS) was primarily designed to monitor stellar light curves and detect exoplanets. However, its full-frame images (FFIs) could be valuable for studying low surface brightness objects. In this work, we construct a full-sky map from TESS image patches in HEALPix format with a pixel size of 1.7'×1.7'. To enhance the usability of the map for extragalactic studies, we remove about 4 hundred millions foreground stars detected in Gaia. The resulting map provides a powerful tool for stacking analyses of extended structures beyond the Milky Way, including galaxies, galaxy clusters, and large-scale structures. This map offers new opportunities for exploring faint astrophysical phenomena at large scales.

Section:

Galaxy/Extragalactic

Poster-Facilities / **185**

Airy 艾里

Author: Wen-Hsin Chen[None]

Section:

Poster-HE - Board: 65 / **109**

An Analysis of the Relationship Between X-ray Luminosity Functions and Star Formation Rates in Different Types of Galaxies

Author: HUAI-MIN WANG[1]

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This study aims to investigate the characteristics of X-ray sources in elliptical (E), lenticular (S0), spiral (S), and active/interacting galaxies, and analyze their relationship with star formation activity. We use X-ray data from the Chandra X-ray Observatory, combined with infrared observations from Spitzer and Herschel, to estimate the star formation rate (SFR) using the X-ray luminosity function (XLF) and infrared luminosity (IR luminosity).

Through XLF analysis, we classify X-ray sources into high-mass X-ray binaries (HMXB) and low-mass X-ray binaries (LMXB), while excluding the influence of active galactic nuclei (AGN). Using linear fitting and Bayesian MCMC methods to estimate the slope (α) of the XLF, the results show that the XLF slope α ranges from -1.5 to -0.96, with a certain similarity in the X-ray source luminosity distribution across different galaxies. The Bayesian MCMC method is more stable than the linear fitting method, with the resulting α values concentrated between -1 and -1.1, indicating that the XLF follows a general exponential decay trend.

The XLF of elliptical galaxies (e.g., NGC 4486) is steeper ($\alpha \approx -1.48$), reflecting a larger contribution from LMXBs, which is consistent with a low SFR environment. The XLF of spiral galaxies (e.g., NGC

4569, NGC 4192) is flatter (α ≈ -0.96 to -0.97), likely dominated by HMXBs and associated with higher SFR. Furthermore, comparing the XLF with SFR estimates derived from infrared luminosity, we find that the XLF of HMXB-dominated galaxies is flatter and associated with higher SFR, while the XLF of LMXB-dominated galaxies is steeper and associated with lower SFR. These results further support the feasibility of using XLF as an indicator for estimating SFR. Overall, the characteristics of the XLF in different galaxy types are closely related to their star formation history, providing important insights for estimating SFR using X-ray observations.

Section:

High Energy

Poster-Solar - Board: 6 / **66**

An Investigation in the orbital evolution of the Near-Earth Asteroid Eros

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Co-authors: Wing-Huen Ip [2]; Yu-Chi Cheng [3]

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Abstract

In the past research of 433 Eros [1] mentioned that there would probably become the Earth-crossing asteroid within many numerical simulation tests. In this research, we deeply investigated the orbital evolution of 433 Eros. In addition to simulate 433 Eros' orbital evolution, we checked when Eros encounters the Earth, and even hits the Earth. Then, since with long-time simulations the large different results are occurred by the small differences of initial conditions and sets, so we use cloning particles, whose orbital elements with covariance matrix, and observe these evolution. Finally, we need to make a conclusion, determining the most possible results among them, inferring the reasonable process of the evolution. To simulate 433 Eros' orbital evolution, we used two packages, REBOUND and MERCURY. We used MERCURIUS integrator in REBOUND, and the similar method with MERCURY, using Hybrid symplectic integrator for planetary dynamics [2]. We used data in JPL Horizons systems, including the covariance matrix for generating the clones. We probably select the most similar one of the past in our results. So far, we hoped the reasonable reason come out, more discussions in Eros'orbital evolution. Last but not least, we even hoped that we could find out the accurate change in every Eros' orbital elements. Therefore, after simulating Eros' orbital evolution, we believed there would become vary results in the future. In short, we should always keep concentrating on these initial conditions, hoping the slower time to hit the Earth.

Reference

[1] P. Michel+; Nature; 380, 25; 1996
[2] Hanno Rein+; MNRAS; 465, 5490-5497; 2019

Section:

Solar System/Exoplanets

Poster-HE - Board: 56 / **53**

An empirical microphysical determination of cosmic ray transport in the Gould's Belt

Authors: Ellis Owen[1]; Szu-Ting Chen[2]

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Cosmic rays (CRs) influence the ionization, heating, and astrochemistry of interstellar molecular clouds. Their propagation through the complex structure of these clouds remains unsettled but appears to transition from diffusion in magnetized turbulent regions to ballistic streaming in dense cores. Efforts to characterize CR diffusion under varying physical conditions have produced a wide range of results. These studies typically rely on large-scale observable signatures to estimate an effective diffusion coefficient, but are not derived from the gyro-scale microphysics that fundamentally governs CR transport. As a result, it is difficult to disentangle CR propagation effects from other environmental factors that may influence the observed signatures. In this talk, we present a new method to empirically construct a diffusion coefficient for molecular clouds based on small-scale magnetic field properties. We use the angular dispersion function of 850 μm dust continuum linear polarization data to estimate the magnetic field strength, and apply a Fourier transform to extract the magnetic power spectrum. Together, these measurements provide sufficient information to characterize the propagaiton of CRs, grounded in the underlying microphysics. As a demonstration, we apply our method to JCMT observations of molecular clouds in the Gould's Belt, enabling an estimate of the CR diffusion coefficient at tens of TeV. This work provides a first validation of the method and lays the foundation for future extensions to lower CR energies with higher-resolution ALMA data.

Section:

High Energy

Poster-Solar - Board: 7 / **73**

Assessing Exomoon Detectability in TESS Light Curves: A Case Study of TOI-2010

Authors: Wen Chi Cheng[1]; Ing Guey Jiang[1]

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Over the past decades, photometric methods have led to the discoveries of thousands of exoplanets. While similar techniques have been used to search for exomoons, none have been confirmed. We aim to survey potential exomoons using Transiting Exoplanet Survey Satellite (TESS) data and present a case study to illustrate our methodology. Based on previously proposed systems with exomoon candidates, we focus on systems with long orbital periods (>100 days). We study the TOI-2010 system, which hosts a Neptune-sized planet with a 141-day orbit. Considering reasonable sizes of exomoons on stable orbits, we generate synthetic light curves of one planet plus one moon cases. The synthetic light curves adopt the properties and noises of TESS light curves of TOI-2010. We then employ a standard procedure to examine exomoon detectabilities from synthetic light curves. With a huge amount of synthetic light curves derived from various exomoons, the detectability of exomoons from TESS data could be determined quantitatively.

Section:

Solar System/Exoplanets

Poster-SF - Board: 24 / **68**

CHIMPS2: Turbulence modes in the Inner Galaxy

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CHIMPS2 is the follow-up to the 13CO/C18O (3 → 2) Heterodyne Inner Milky Way Plane Survey (CHIMPS) and the CO Hi-Resolution Survey (COHRS) and is a Large Program on the JCMT. The CHIMPS2 Inner Galaxy observations cover longitudes between 16° and 47° with $-0.5° \leq b \leq 0.5°$. When combined with the complementary 13CO/C18O/12CO(1-0) survey at the Nobeyama 45m at matching 15 arcsec resolution and sensitivity, and other current CO surveys, CHIMPS2 provides a complete set of transition data with which to calculate accurate column densities, gas temperatures and turbulent Mach numbers, that would otherwise rely on estimations and underlying assumptions. We constructed a novel catalogue of CHIMPS2 Inner Galaxy sources and linked their positions, physical properties and star-forming efficiency to the solenoidal modes of turbulence in the clouds. The range of Galactic longitudes covered by CHIMPS2 allows us to probe the relationship between turbulence modes and different Galactic environments, covering, in particular, the transition into the region spanned by the rotation of the Galactic bar and arm and inter-arm regions.

Section:

Star Formation

Poster-HE - Board: 66 / **117**

Calibration of TAROGE-3 for High-Accuracy Angular Reconstruction

Author: Che-Wei Pai[1]

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Ultra-high energy (UHE) neutrinos and cosmic rays not only provide critical insights into high-energy astrophysical phenomena but also serve as probes for physics beyond the energy scales accessible by human-made accelerators. The Taiwan Astro-Particle Radiowave Observatory for Geosynchrotron Emissions (TAROGE) is an experimental project designed to detect radio emissions from extensive air showers induced by UHE neutrinos and cosmic rays. As one of the observatories in the project, TAROGE-3 consists of six antennas deployed on a mountain along Taiwan's east coast, facing the Pacific Ocean.

To distinguish signals originating from downward-propagating cosmic rays and upward-traveling neutrinos, interferometry plays a crucial role in determining the incident direction of primary particles, necessitating precise synchronization between channels and accurate antenna positioning. In this study, we present the calibration techniques implemented for the TAROGE-3 system, including

photogrammetry, drone-based pulser calibration, and back-end data processing, to meet these requirements. Through these methods, we have achieved an angular resolution of approximately 0.5 degrees and established a solid foundation for further data analysis.

Section:

High Energy

Poster-Stars - Board: 15 / **100**

Characterizing Temperature Variability and Broadband SED Properties of Flares on the M Dwarf Wolf 359 from Simultaneous Multiband Optical Observations

Author: Chia-Lung Lin[1]

Co-authors: Hsiang-Yao Hsiao [1]; Li-Ching Hunag [2]; Wei-Jie Hou [1]; Wing-Huen Ip [1]

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We present a study of flare properties on the highly active M dwarf Wolf 359 using simultaneous multiband ground-based optical observations. High-cadence data were obtained with the instrument TRIPOL on the Lulin 1-m telescope, supplemented by the Lulin 41-cm telescope, over five nights between February 17–22 in 2023. In total, we detected twelve flares. Three flares observed on the first night were captured in the u, g, r, i, and z bands, while the rest were observed in g, r, i, and z bands only. Most flares exhibited significant amplitudes in the u, g, and r bands; only six flares were detectable in the i band, and none in the z band. The most energetic flare released ~10^{30} erg in the g and r bands. Using both three-color SED fitting and two-color ratio methods, we found that most flare peak temperatures in the g band are cooler than the empirical 9000 K, with an average of 6022 ± 1533 K. The hottest flare reached 10,155 K, and the coolest was ~4080 K. Most flares were complex, multi-peaked events, with the hottest moments generally misaligned from the optical brightness peaks. We also investigated the relationship between flare temperature and other parameters. Notably, the u-band amplitudes were brighter than the derived temperatures expected, suggesting a dominant contribution from the Balmer continuum. Additionally, the u-band decay timescale was longer than in g and r, implying differences in cooling mechanisms of heated active regions in the chromosphere and photosphere for this star.

Section:

Stars/Star Clusters

Poster-Solar - Board: 5 / **48**

Collisional Ejection of Helium Atoms in the Martian Atmosphere

Author: Hua-Shan Shih[1]

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Non-thermal escape via hot oxygen production, primarily from the dissociative recombination of O_2^+, significantly influences atmospheric loss on Mars. These hot oxygen atoms can collide with other atmospheric species, such as helium and minor gases, affecting their energy distributions and contributing to escape processes. Previous studies have indicated that solar wind helium contributes significantly to Mars'atmospheric helium through the neutralization of α-particles, with an estimated deposition rate of approximately 1.5×10^{23} atoms s^{-1} (Chanteur et al., 2009). It has also been suggested that nearly 95% of helium escape occurs below the exobase, primarily due to energy transfer from hot oxygen atoms (Gu et al., 2020). In this study, we expand upon previous work by employing a Monte Carlo simulation integrated with our established hot oxygen model to investigate the collisional ejection of solar wind–originated neutral helium atoms, tracking their evolution in the Martian upper atmosphere.

Section:

Solar System/Exoplanets

Poster-Stars - Board: 12 / **18**

Comparing the Impact of G Magnitude Selection on Earth's Microlensing Detectability Using Gaia DR3

Author: Thansuda Chulikorn[1]

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Gravitational microlensing is an essential technique for detecting small exoplanets, including Earth-like planets. Interestingly, from an alternative perspective, the Earth Microlensing Zone (EMZ) can be defined as the region where extraterrestrial civilizations could observe gravitational microlensing events caused by Earth. Updating the EMZ map is crucial for improving microlensing detectability predictions and refining the search scope for extraterrestrial intelligence (SETI) missions. In this study, we compute and analyze the microlensing probability, average caustic crossing time, and Earth microlensing discovery rate using stellar parameters from the *Gaia* Data Release 3 (DR3) catalogue. We compare the results for stars with G-band magnitudes of 17 and 20 to assess how different brightness thresholds impact Earth's detectability and construct the EMZ map using HEALPix at level 6. Our analysis reveals that the Earth discovery rate is highest along the Milky Way plane, particularly toward the Galactic Centre, due to the high density of potential observer stars. Furthermore, we find that using a fainter magnitude threshold ($G \leq 20$) significantly increases the number of events, with the total Earth discovery rate being approximately 10 times greater compared to the $G \leq 17$ case. This updated EMZ map, including different magnitude thresholds, is a helpful guide for future microlensing surveys. It also enhances the search for habitable exoplanets and extraterrestrial observers by offering a deeper understanding of Earth's detectability through microlensing.

Section:

Solar System/Exoplanets

Poster-HE - Board: 55 / **33**

Correlation Between Orbital Modulation Parameters and X-ray Flux in Low-Mass X-ray Binary 4U 1820-30

Author: Jun-Lei Wu[1]

Co-authors: Bo-Chun Chen [1]; Yi Chou [1]

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The ultra-compact low mass X-ray binary 4U 1820-30 exhibits a ~3% orbital modulation in its X-ray light curve with a period of 685 seconds, along with a superorbital modulation where the flux varies by a factor of 2 over a period of ~170 days. Zdziarski et al.(2007), using early RXTE data, discovered a correlation between the amplitude of the orbital modulation and the accretion rate, suggesting that the superorbital modulation results from variations in mass transfer from the companion star. To further verify this dependence, we analyzed data collected by RXTE's PCA and ASM instruments, as well as recent observations from NICER and MAXI. We found a similar dependence not only in the RXTE data but also in the recent NICER and MAXI observations. We therefore confirm that the superorbital modulation of 4U 1820-30 is driven by mass transfer from the companion star.

Section:

High Energy

Poster-EA - Board: 44 / **141**

C^+ as Tracer of Molecular Hydrogen and Star Formation Rate in Galaxies

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Understanding the distribution of molecular hydrogen (H_2) is essential for studying star formation in galaxies. However, direct observations of H_2 are difficult. Carbon species such as carbon monoxide (CO) and ionized carbon (C^+) might be used as good tracers of molecular hydrogen, as their formation is closely related to the presence of H_2.

In this study, we perform high-resolution galaxy simulations using the GIZMO code, and conduct post-processing to calculate the abundance and emission of C^+. We aim to investigate how well the tracer correlates with H_2 and star formation, especially in low-metallicity environment. This work will help to improve our understanding of molecular gas tracer and its connection to star formation.

Section:

Galaxy/Extragalactic

Poster-SF - Board: 28 / **168**

Deciphering the Star Formation Status of the Musca Molecular Cloud Filament

Authors: Hsiang-Yu Chen[1]; Wen-ping Chen[2]

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The Chamaeleon cloud complex is active in star formation hosting hundreds of newly born stars. Yet the adjacent Musca cloud, filamentary in shape, seem to be barren, with only a few dense cores detected, signifying the cloud being prestellar. While a far-infrared source, IRAS 12322-7023, on the basis of its IRAS colors, was reported in the literature as a T Tauri candidate, i.e., a newly formed star, it was later re-classified as an asymptotic giant branch (AGB) star, namely an evolved object with a He exhausted core, plus H and He burning shells, although the characteristic 1612-MHz OH maser line has not been detected. Analysis based on the latest Gaia photometry and astrometry detects no young population in the cloud, and IRAS 12322-7023 is too faint for Gaia. Here we diagnose its proper motion derived from 2MASS and ALLWISE, and Spitzer images, using neighboring bright stars with Gaia measurements as astrometric references. Our diagnosis will address whether there is a full-grown star in the cloud, indicative of ongoing star-forming activity, and if so, a possible link with the star formation history in the nearby Chamaeleon region.

Section:

Star Formation

Poster-EA - Board: 49 / **182**

Decoding the cosmological baryonic fluctuations using localized fast radio bursts

Author: Tzu-Yin Hsu[1]

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The enigma of the missing baryons poses a prominent and unresolved problem in astronomy. Dispersion measures (DM), serving as a distinctive observable of fast radio bursts (FRBs), quantify the electron column density along each line-of-sight, revealing the missing baryons described in the Macquart (DM-z) relation. The scatter of this relation is anticipated to be caused by the variation of cosmic structure. However, this is not yet statistically confirmed. Here, we present the statistical evidence of the cosmological baryonic fluctuations. We calculate the foreground galaxy number densities around 14 and 13 localized FRBs are measured with WISE-PS1-STRM and WISE × SCOS photometric redshift galaxy catalog, respectively. The foreground galaxy number densities are determined through a comparison with measuring random apertures with a radius of 1 Mpc. We found a positive correlation between the excess of DM contributed by the medium outside galaxies (DMcosmic) and the foreground galaxy number density. The correlation is strong and statistically significant with median Pearson coefficients of 0.6 and 0.6 and median p-values of 0.012 and 0.032 for the galaxy catalogs, respectively, calculated by Monte Carlo simulations. Our findings indicate that baryonic matter density outside galaxies exceed its cosmic average along the line-of-sight to regions of excess galaxy-density, whereas there is less amount of baryons along the line-of-sight

to low-density regions, presenting statistical evidence for cosmological fluctuation of the ionised baryons on a characteristic scale of < 6 Mpc.

Section:

Poster-Stars - Board: 14 / **89**

Diagnosis of substructures around the rare double cluster h and χ Persei

Authors: Jia-syuan Wu[1]; Wen-ping Chen[2]

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We present the discovery and characterization of debris stellar groups around the Double Cluster h (NGC 869) and chi (NGC 884) Persei to diagnose the formation and dynamical evolution of binary star clusters. Stars are formed in groups, and those surviving the emergence out of the molecular clouds become a star cluster. Open star clusters, primarily located in the Galactic disk, are particularly vulnerable to continuous disintegration: (1) Two-body relaxation among member stars leads to ejection of low-massive members, ever shallowing the gravitational potential, (2) External tidal disturbances exacerbate the situation, manifest by tidal tails or debris stellar groups sharing the same volume and motion with the parental cluster. Then-members of dissolved clusters constitute the Galactic field stars. While the majority of stars have companions, and pair galaxies are common, double star clusters are relatively rare. Using the astrometry and photometry from the latest space mission Gaia (Data Release 3), we identified more than a handful of distinct groups, some found for the first time, with distance and space motion consistent with those of the Double Cluster. We derived for each group its size, age, and number of members. We offer convincing evidence of some groups being ejected as the cluster pair orbits each other.

Section:

Stars/Star Clusters

Poster-EPO - Board: 79 / **16**

Education and Public Outreach Activity in ASIAA

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The Education and Public Outreach (EPO) team in Academia Sinica Institute of Astronomy and Astrophysics (ASIAA) works on public relations, websites, publication, educational and promotional activity and collaboration. Public relations include ASIAA science highlights, news releases and press conferences. We also have Facebook and YouTube channel to promote the most updated information and videos. The publication includes the IAA Quarterly (IAAQ) that we have sent each issue to more than 150 schools in Taiwan. The educational activities include the annual Academia

Sinica Open House and teachers'workshops. We also collaborate with several museums such as the Taipei Astronomical Museum, the National Museum of Natural Science and the Open Museum, for supporting the related exhibitions and public talks.

Section:

Outreach and Education

Poster-HE - Board: 70 / **130**

Effects of Magnetoconvection in Core-Collapse Supernovae

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Multi-dimensional instabilities coupled with magnetic fields, such as the magnetorotational instability (MRI), are considered important contributors to the explosion mechanism of core-collapse supernovae in extreme scenarios. In this work, we present three-dimensional simulations of a 40-solar-mass progenitor using the GPU-accelerated magnetohydrodynamics code GAMER. We investigate the effects of magnetic field strength, initial rotation, and spatial resolution on the explosion dynamics and resulting multi-messenger signals. Our preliminary results indicate that MRI can be triggered in the convective region within the proto-neutron star when the spatial resolution reaches below 250 meters. The development of MRI leaves distinct multi-messenger signatures, which may be detectable in future gravitational wave observations.

Section:

High Energy

Poster-Facilities - Board: 85 / **34**

Efficient Image Visualization and Analysis with CARTA - Cube Analysis and Rendering Tool for Astronomy

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CARTA (Cube Analysis and Rendering Tool for Astronomy) is a state-of-the-art software designed for image visualization and analysis in astronomy, developed by an international collaboration from ASIAA, IDIA, NRAO, the Dept. of Physics University of Alberta.

CARTA is a powerful tool for astronomical data with high performance in visualizing large images/data cubes (~1 TB size data cube can be loaded in seconds with ~1 GB of RAM). CARTA handles not only radio data cubes but also optical/IR images and IFU data. CARTA provides a wide range of efficient tools –annotation, contour, spectral line-related analysis, catalog visualization, etc. CARTA produces publication-qualified figures. CARTA is highly interactive empowering users to explore their data in real-time, for example: i) The interactive PV (Position-Velocity) image preview. Users can see the resulting PV images on the fly by adjusting the PV cuts. ii) One-step color (RGB) blending by simply loading different wavelength images and tuning the weighting for each wavelength. iii) The channel map view allows users to show the selected channel range with a free layout for displaying channels. CARTA is to support your research and study and has many more feathers waiting for you to explore.

Section:

Facility Program

Poster-HE - Board: 67 / **118**

Energy Calibration of The Gamma-ray Transients Monitor

Authors: Hao-Min Chang[None]; Hsiang-Kuang Chang[None]; Chih-Hsun Lin[1]; Che-Chih Tsao[2]; Chin-Ping Hu[3]; Ching-Wen Chiu[None]; Hsiang Chu[None]; Hong-Yi Chen[None]; An-Hsuan Feng[None]; Cheng-En Lo[None]; Tzu-Hsuan Lin[4]; Yi-Sian Lee[None]; Chih-En Wu[5]; Yu-Hua Wang[None]

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The Gamma-ray Transients Monitor (GTM) is a science payload on the Taiwanese satellite Formosat-8B, designed to detect GRBs and other gamma-ray transients in the 50 keV to 2 MeV range. It consists of two detector units, each with four sensor modules using GAGG(Ce) scintillators and Silicon Photomultipliers (SiPMs), providing all-sky coverage.
In this report, we present the energy calibration of GTM, which is essential for accurately interpreting the detector readout signals. We performed radiation measurements using multiple isotopes to establish the ADC-to-energy relationship for all channels. Finally, we obtained the energy resolution as a function of energy for all detectors.

Section:

High Energy

Poster-EA - Board: 51 / **156**

Exploring the Environments of Fast Radio Bursts via Host Galaxy Characterization

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This study aims to investigate the properties of host galaxies of Fast Radio Burst (FRB). We begin by extracting FRB event data from the Transient Name Server (TNS), using their sky positions (Right Ascension and Declination) and observed Dispersion Measures (DMs) to identify potential host galaxy candidates. By cross-matching with astronomical catalogs such as SDSS and Gaia, we filter out galaxies with redshifts and sky positions. Subsequently, we use the stellar population synthesis model Prospector to fit the photometric data of candidate host galaxies, deriving key physical parameters including stellar mass, star formation rate (SFR), dust extinction (A_v), and stellar population age. Through this multi-step approach, we aim to identify common characteristics among FRB host galaxies and provide observational insight into the environments where FRBs are most likely to originate.

Section:

Galaxy/Extragalactic

Poster-EA - Board: 48 / **151**

FRB detection pipeline development and validation using simulated and observed data with FAST

Author: Tsung Ching Yang[1]

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Fast radio bursts (FRBs) are millisecond-duration, coherent radio transients with unknown origins. They are generally classified into two types: repeating and non-repeating FRBs. These two categories are believed to arise from different physical mechanisms—for instance, starquakes on neutron stars for repeaters, and binary mergers for non-repeaters. Therefore, determining whether an FRB is a repeater is crucial to understanding its origin. However, due to instrumental limitations and restricted observational time, most detected FRBs appear non-repeating observationally, although they might be misclassified. To overcome this problem, machine learning (ML) has become a powerful tool to predict which non-repeating FRBs may eventually exhibit a repeating behavior. FRB 20190110C is one of such repeater candidates selected by ML (Chen et al. 2022). This FRB was later confirmed by the CHIME/FRB team, marking a significant validation of the ML method. Following this, we conducted an 11-day monitoring campaign of FRB 20190110C with a 10-minute exposure each day, totaling 110 min, with the Five-hundred-meter Aperture Spherical Telescope (FAST). I led the development of the data analysis pipeline, which involved RFI mitigation using sigpyproc and candidate searching with heimdall. From our observations, we identified 2,095 candidates. Although none were confirmed as detections after manual inspection, we validated our pipeline using simulated FRB signals, which showed clear detections. This confirms the reliability and effectiveness of our pipeline for future FRB detection efforts. Additionally, based on our non-detection results, we placed constraints on the repeating rate of FRB 20190110C and estimated the Weibull clustering parameter, providing further insight into the source's repeating behavior.

Section:

Galaxy/Extragalactic

Poster-EA - Board: 37 / **96**

Formation of Supernova Remnants in Dwarf Galaxies

Author: Pei-Cheng Tung[1]

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Massive stars end their lives in powerful explosions known as supernovae (SNe), which evolve into supernova remnants (SNRs). SNRs carry the legacy of their progenitor stars, enriching the interstellar medium (ISM) with stellar material and playing a crucial role in shaping the ISM ecosystem within galaxies.
In this study, we present the high-resolution simulations of SNRs in dwarf galaxies with the GIZMO code. Unlike previous studies, we employ realistic dwarf galaxy models from Tung & Chen (2025) and incorporate key physical processes governing SNR formation. Our results reveal how SNRs contribute to chemical enrichment from stellar to ISM and galactic scales. Furthermore, we find that the galactic environment significantly influences the formation and evolution of SNRs, highlighting the complex interplay between SNe feedback and dwarf galaxy dynamics.

Section:

Galaxy/Extragalactic

Poster-HE - Board: 61 / **92**

From Simulations to Spectra: Investigating AGN Wind-Disk Interactions and Asymmetric Galactic Outflows

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We use 3D special relativistic hydrodynamic (SRHD) simulations to study AGN-driven winds in a disk galaxy. Our results reveal an early-stage (t ~ 0.1 Myr) asymmetry in bubble formation, with one bubble reaching velocities up to 2000 km/s while the other remains underdeveloped due to interactions with the clumpy disk. This aligns with JWST observations of NGC 7469, which show a circumnuclear starburst ring and one-sided high-velocity outflows.
To explore observational signatures, we generate mock spectra using TRIDENT, finding that the asymmetry is detectable in the [NeV] line at optical wavelengths, as TRIDENT produces spectra comparable to HST rather than JWST. Phase diagrams suggest that matching observed emission requires the disk density in our simulations to be at least an order of magnitude lower. These findings provide insight into AGN wind-disk interactions and offer a potential explanation for the asymmetric outflows in NGC 7469.

Section:

High Energy

Poster-EA - Board: 50 / **183**

How many fast radio bursts are we missing?

Author: Albert Kong[None]

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Fast radio bursts (FRBs) are millisecond-duration radio transients whose population characteristics remain poorly constrained. This study applies capture-recapture analysis, an established statistical method in ecology and epidemiology, to estimate the unseen population of FRBs based on repeat detections from current radio surveys. By treating FRB detections as "captures" and accounting for the probability of re-detection across multiple observing epochs in the CHIME/FRB Catalog 1, we model the total FRB population, including those yet undetected. Preliminary results suggest a substantially larger population of FRBs than currently cataloged.

Section:

Galaxy/Extragalactic

Poster-Solar - Board: 3 / **40**

Identifying Binary Asteroids Using Machine Learning with Simulated Lightcurves and FOSSIL Survey Data

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Binary asteroids provide crucial information of the solar system evolution. This study presents a machine learning (ML) approach, using Random Forest classifiers, to identify binary asteroids from lightcurves. We aim to study the population of binary asteroids in the main asteroid belt. To achieve this, we develop the asteroids model to simulate the lightcurves as the training set, which including shape, rotation, and orbit to simulate the photometric properties of asteroids and binary.

In the study, we generated the training set according to the parameter of binary groups which observed before, the noise level also considered. We apply feature engineering to transform lightcurves into descriptive properties, enhancing the model's predictive performance. Then, the trained ML model is then applied to observational lightcurves from the FOSSIL survey, a wide-field high-cadence observation for small solar system bodies (SSSBs), which has $\sim$ 12000 lightcurves of main-belt asteroids (MBAs) and identify a couple of dozens of binary systems candidates from it.

Section:

Solar System/Exoplanets

Poster-SF - Board: 22 / **65**

Identifying star-forming cores in 13CO emission maps: Evolution stages of molecular clumps

Authors: Chung-Chen Chang[1]; Raffaele Rani[2]; Yueh-Ning Lee[3]

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Multi-tracer surveys have revealed the hierarchical nature of molecular clouds, showing how high-density, small-scale features are always nested within more rarefied, larger envelopes. This structural hierarchy is, however, a non-trivial one: over-densities can always be found when smaller scales are resolved. The highest density in the hierarchy of cloud structure correspond to the site of star formation. We use the SCIMES (Spectral Clustering for Molecular Emission Segmentation) algorithm to identify the densest regions (the leaves of the dendrogram) of the 13CO emission maps of the CO Heterodyne Inner Milky Way Plane Survey (CHIMPS; JCMT). To identify star-forming clumps at different stages of their evolution, we match the CHIMPS leaves with the sources in the ATLASGAL (APEX Telescope Large Area Survey of the Galaxy), which provides a catalog of clumps with their physical properties and evolution stages (YSO, protostellar core, quiescent, massive-star forming). Our study indicates that most leaves contain one single type of ATLASGAL source, with young stellar objects being by far the most dominant.

Section:

Star Formation

Poster-HE - Board: 62 / **102**

Impact of chiral effects on core-collapse supernova dynamics

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Chiral effects induced by quantum anomalies, such as the chiral magnetic effect, are expected to influence the dynamics of core-collapse supernovae (CCSN). These effects arise in strong magnetic fields and rapid flows, which are common in supernova cores. In this project, we investigate the potential impact of chiral neutrino radiation transport in CCSN, focusing on contributions from neutrinos near equilibrium. We use an approximate formula for the chiral corrections to the neutrino radiation energy-momentum tensor $\partial_\mu T^{\mu i}_{\rm rad}$ from the work of Yamamoto & Yang (2021). We investigate the potential contributions from these chiral corrections on self-consistent 2D CCSN simulations with neutrino transport. We find that some of the chiral correction terms can significantly contribute to momentum changes and, therefore, can have a crucial impact on the dynamics of the proto-neutron star around the core bounce. This effect might be one of the origins of the popular kick.

Section:

High Energy

Poster-HE - Board: 72 / **144**

Improved Electron Temperature Modeling for M87 Black Hole Imaging

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The observation of the M87* black hole shadow has opened new avenues for exploring horizon-scale phenomena around astrophysical black holes.
Current interpretations of black hole images often rely on state-of-the-art general relativistic magnetohydrodynamics (GRMHD) simulations to model ion
temperatures, combined with post-processed radiative modeling of electron radiation. However, these approaches typically estimate the ratio between
ion and electron temperatures using assumed parameterizations based on parameters such as the local plasma beta, which may not fully capture the
underlying physics. To address this, we propose an alternative approach that estimates the electron temperature by considering inverse Compton
cooling (ICC) and Synchrotron cooling, allowing for a more accurate determination based on the local energy balance of electrons. We present a comparison of
electron temperatures and the resulting black hole images between the conventional parameterization and our new method, highlighting potential
improvements in modeling horizon-scale emission.

Blockquote

Section:

High Energy

Poster-EA - Board: 38 / **105**

Improving Cluster Shape Measurements for IA Studies

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We aim to study the intrinsic alignment (IA) properties of galaxy clusters within the large-scale structure (LSS) of the Universe. This task was usually carried out by using an optically selected sample of galaxy clusters, whose member galaxies are identified by optical cluster finders that can be directly used to estimate the projected shapes of the halos. However, optically selected clusters are prone to the effect of line-of-sight projection, leading to a result that is challenging to model. In this study, we develop a statistical method to estimate the projected shape of galaxy clusters selected based on their intracluster medium (ICM), nearly free from the projection effect. We apply this method to the cluster sample selected in the South Pole Telescope (SPT) survey in a combination

with the optical galaxy catalogs from the Dark Energy Survey (DES). We will present the preliminary results and their validations in this meeting.

Section:

Cosmology

Poster-GW - Board: 77 / **104**

In search of gravitational waves from fast X-ray transients

Author: Po-Ya Wang[1]

Co-authors: Albert Kong [1]; Surojit Saha [2]

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Fast X-ray Transients (FXTs) are brief, intense X-ray flashes unassociated with persistent X-ray sources or known stellar objects, typically lasting from seconds to hours. Previous studies have identified the origins of some FXTs, e.g., XRO 080109/SN2008D as supernova shock breakouts and EP240315a as long-duration Gamma Ray Bursts. In the past 4 decades, a portion of FXTs have been identified as Gamma-Ray Bursts (GRBs). However, the origins of the rest of the FXTs remain uncertain, prompting the development of theoretical models, including binary neutron star mergers, accretion-induced collapse of compact objects and Tidal disruption events.
With the launch of Einstein Probe in January 2024, the study of FXTs has entered a new phase. Its large field of view significantly increases the discovery rate, enabling a more robust statistical analysis. As of April 2025, Einstein Probe has reported approximately 80 FXTs —about four times the 22 events identified by Chandra between 2000 and 2022.
We propose a methodology to search for possible relations between Gravitational Waves and FXTs. To achieve this, we intend to utilize X-Pipeline, an unmodeled search algorithm to identify excess coherent signals in LIGO-Virgo-KAGRA (LVK) O4 observations. By applying minimal assumptions, the search aims to test the existence of any temporal and spatial correlation, which may provide new insights into the physical mechanisms driving these transient X-ray events.

Section:

High Energy

Poster-EA - Board: 47 / **166**

Interstellar Prisms: Unlocking Small Scale Dispersion Measure Variations with Pulsars

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Pulsar dispersion measures have long been an important probe of the distribution of free electrons in the interstellar medium (ISM). However, the cadence of pulsar observations, combined with the uncertainty on individual dispersion measure measurements limits our ability to probe small scale

variations in the ISM. Here, we present a novel method for measuring changes in dispersion measure along nearby sightlines towards a pulsar from a single observation by leveraging multiple images formed by refraction of the pulsar signal by an interstellar lens. We show how the small scale strucutre evolves over a series of observations, and discuss the implications for astrometry and timing.

Section:

Galaxy/Extragalactic

Poster-EA - Board: 42 / **129**

Investigating Cold Gas Filaments in Cool-core Clusters

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Aims. Cold gas ($T \sim 10^4$ K) filamentary structures with Hα emissions were found around central regions of some
cool-core galaxy clusters. We wish to compare the results
between the observation of the Perseus cluster and our simulation
in order to interpret velocity structures of observed filaments.
Methods. We perform hydrodynamic simulations to trace gas
motions in the Perseus cluster.
Results. In our simulation, filaments with a chaotic velocity
structure dominate the population, while those with a uniform
velocity structure are secondary. The simulation also produces
an overall low velocity dispersion.
Conclusions. The cold gas motions present chaotic more
often, whereas observations suggest an uniform structure. On
the other hand, the velocity dispersion in the simulation is
consistent with the observation results.

Section:

Galaxy/Extragalactic

Poster-HE - Board: 69 / **126**

Investigating Potential Magnetar-like FRBs Through UMAP Analysis of CHIME/FRB Data

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Fast Radio Bursts (FRBs) are high-energy, transient phenomena with extremely short durations, and their origin remains uncertain. Various theories have been proposed to explain their mechanism. Among these, FRB 200428 has been confirmed to originate from the magnetar SGR 1935+2154, providing a potential model for understanding other FRBs. In this study, I use the physical parameters of

FRB 200428 as a reference, assuming that the sources in the CHIME/FRB Catalog are at the same distance. Based on this assumption, I compute the corresponding physical parameters for these sources. The CHIME/FRB Catalog offers a rich dataset, which includes both repeating and non-repeating FRBs. To analyze this data, I apply Uniform Manifold Approximation and Projection (UMAP) for classification, aiming to determine whether other sources exhibit similar physical processes as FRB 200428.

Section:

High Energy

Poster-EA - Board: 36 / **94**

Investigating the Redshift Evolution of Dynamical States and Mass–Dispersion Relations in Galaxy Clusters from the TNG300 and TNG-Cluster Simulations

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Galaxy clusters are the most massive gravitationally bound systems and represent the most recently formed structures in the Universe under the hierarchical formation model. In this work, we reconstruct the dynamical mass profiles of galaxy clusters from the TNG300 and TNG-Cluster simulations by numerically solving the Jeans equation based on the kinematics of member galaxies. By comparing our results with the simulations' true mass profiles, we assess the dynamical states of the simulated galaxy clusters and track their evolution with redshift. We explore the mass–velocity dispersion relation at various redshifts, which also serves as a practical tool for estimating galaxy cluster masses from observed galaxy velocity dispersions. Our results yield simulation-based calculations for the redshift evolution of the dynamical states and scaling relations of galaxy clusters, which can then be cross-checked against observational cluster masses to validate the hierarchical structure formation model.

Section:

Galaxy/Extragalactic

Poster-HE - Board: 59 / **81**

Investigating the nature of magnetic turbulence in Tycho's SNR using X-ray observation

Author: Ashwin Aravindaraj[1]

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Supernova remnants (SNRs) are considered the primary sources of Galactic cosmic ray acceleration. Particles are energized at the shock front of SNR through the diffusive shock acceleration mechanism, gaining energy by repeatedly crossing the shock. Magnetic turbulence plays a crucial role in scattering these particles back and forth; therefore, investigating this turbulence is essential for understanding the acceleration mechanism. The two-point correlation function can be used to study the magnetic energy spectrum using observational data. In this study we have employed poissonian based generalized morphological component analysis method to separate non-thermal emission in the Tycho's SNR and have employed two-point correlation method on the X-ray flux image and X-ray rim thickness around the forward shock which is directly dependent on the magnetic field strength to study the magnetic energy spectrum.

Section:

High Energy

Poster-EPO - Board: 84 / **162**

K-12 Astronomy Education Conference in Asia

Author: Hao-Yuan Duan[None]

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Advertise the K-12 Astronomy Education Conference in Asia.
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Section:

Outreach and Education

Poster-EA - Board: 29 / **38**

Latest Progress in the Search for Extragalactic Technosignatures with MeerKAT

Author: Yuri Uno[1]

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The Search for Extraterrestrial Intelligence (SETI) has historically concentrated on detecting technosignatures within the Milky Way, targeting individual stars. The absence of confirmed signals

over six decades may stem from the narrow scope of these efforts. This study shifts the SETI framework to galaxy clusters, where advanced civilizations—potentially at higher Kardashev scale levels—could exist, enabling observation of far more stars than conventional Milky Way surveys. We employ the MeerKAT radio interferometer in South Africa, leveraging its high sensitivity and expansive field of view, to search for technosignatures in galaxy clusters. Our observations utilize the Breakthrough Listen User Supplied Equipment (BLUSE) system, tailored for SETI commensal observations, and build on prior work with new data from 2023.

We target narrowband drifting radio signals, improbable from natural astrophysical processes, as prime candidates for artificial origin. An optimized pipeline identifies these signals while robustly mitigating terrestrial radio frequency interference (RFI). This presentation highlights our latest observations, refined data processing techniques, and updated detection statistics.

Though no compelling technosignature candidates surfaced in the recent dataset, our findings impose stricter limits on the prevalence of bright narrowband transmitters. These insights refine future SETI approaches and affirm the power of commensal observations with advanced arrays like MeerKAT.

Section:

Galaxy/Extragalactic

Poster-Solar - Board: 9 / **139**

Lightcurve and Color Index of Jupiter Trojans in L5 from ZTF Observations

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We present an analysis of observations pointing on the trailing L5 cloud using the Zwicky Transient Facility in early Oct and Nov of 2024. The obtained images with the g' and r' filter allowed for the measurement of g − r color. We detected 579 Trojans in the observed fields, and the median value of g'-r' color is 0.633 ± 0.094. Because each target had at least five g-r data sets and therefore some of them would have more data points allowing them to determine the rotation period. We found the derived period is consistent with Asteroid Lightcurve Database (LCDB). The absolution magnitude can be derived and the size distribution in L4 will be derived and compared to the other survey.

Section:

Solar System/Exoplanets

Poster-HE - Board: 60 / **88**

Localization Performance of a Compact GRB Monitor to Fly on a future Cubesat

Author: Kaustubha Sen[1]

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This paper reports the localization performance analysis of a compact GRB monitor to fly on a future cubesat. This proposed GRB monitor consists of four hexagonal CsI scintillator detectors of geometric area 12.5 cm^2 encased in 2 mm thick aluminium (Al7075) on the sides and one square detector of area 8 cm^2 on the top. All detectors have a thickness of 0.5 cm. The base of the detector module has a 0.3 mm thick tungsten layer to protect the SiPM from radiation damage. In this study, we prepare 2 simulation models of the instrument using MEGAlib/Geomega - one with 5 detectors (4 hexagonal + 1 square on the top) and the other with only the 4 hexagonal detectors. We run simulations with MEGAlib/Cosima to study the localization capability of such an instrument and how much it can improve due to the presence of the top detector.

Section:

High Energy

Poster-GW - Board: 76 / **63**

ML investigation of GW SkyLocator with the application of Auto-Regressive Quadratic-Spline flow.

Authors: Yi-Sheng Huang[1]; Lupin C. C. Lin[1]; Chih-Yi Chang[2]; Jheng-Min Chen[3]; Chayan Chatterjee[4]; Kwan-Lok Li[1]

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With the growing population of gravitational-wave (GW) events, electromagnetic (EM) follow-up observations have become important for multi-messenger astronomy. Since the EM afterglows of the compact binary coalescences (CBCs) decay rapidly, prompt and reliable GW localizations are essential for the EM counterpart identification. This poster presents the results of the Auto-regressive Rational Quadratic Spline (ARQS) GW-Sky Locator, which provides fast GW localizations comparable to the conventional rapid sky localization Bayestar method. Auto-regressive normalizing flow was employed to compute the probability density of a GW location from an initial normal distribution. We then performed deep learning to infer the probability density in astronomical coordinate systems.

Section:

Cosmology

Poster-SF - Board: 20 / **52**

Magnetic field–gas density relation in Dense Cores with Different Collapsing Types

Authors: Jo-Shui Kao[1]; Shih-Ping Lai[2]; Hsi-Wei Yen[3]

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When dense cores or molecular clouds collapse, both the gas density (ρ) and magnetic field strength (B) increase (Crutcher+2010). Theoretical models predict that the power-law index of the B–ρ relation depends on the magnetic field orientation and the geometry of the contracting clouds (Tritsis+2015). In this project, we plan to test the core collapsing process predicted by the Textbook model (Li 2017). We first identify cores exhibiting different collapsing types using the James Clerk Maxwell Telescope (JCMT) 850 μm continuum maps. Then, we will estimate the magnetic field strength at each position within the dense cores and molecular clouds by applying the Davis-Chandrasekhar-Fermi (DCF) method and the polarization-intensity gradient method (Koch+2012). This approach allows us to compare the B–ρ relations in different types of collapse. With ALMA data, we can further check the magnetic field structure in the envelope scale.

Section:

Star Formation

Poster-Solar - Board: 1 / **29**

Moon Hunting with TESS: Revealing Exomoons via Transit Timing Variations and Transit Duration Variations

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One of the most fascinating and difficult tasks in contemporary astronomy is the finding of exomoons, the moons orbiting exoplanets. In order to find possible exomoons, this study investigates the use of transit timing variations (TTV) and transit duration variations (TDV) as indirect methods. Our goal is to find the dynamical signatures that indicate to the gravitational impact of an orbiting moon by examining the periodic shifts in transit mid-times and changes in transit durations from light curves of known transiting exoplanets. We use this methodology on publicly accessible Transiting Exoplanet Survey Satellite (TESS) datasets, emphasizing systems with stable orbital parameters, clean transit signals, and efficient data. Corresponding TTV and TDV signals could give persuasive evidence for an exomoon candidate. In addition to providing insights into the possible diversity and the formation of moon systems in the universe, this study advances the larger effort to characterize planetary systems outside of our solar system.

Section:

Solar System/Exoplanets

Poster-HE - Board: 54 / **30**

NGC 7314: X-Ray Study of the Evolving Accretion Properties

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We present an in-depth analysis of the timing and spectral properties of NGC 7314, a Seyfert 1.9 galaxy, using data from XMM-Newton, NuSTAR, and RXTE/PCA. Our timing analysis reveals significant variability across multiple energy bands, with fractional variability (Fvar). We observe that soft X-ray photons exhibit greater variability compared to harder photons, suggesting distinct emission origins: soft photons likely arise from a hot corona near the central region, while high-energy photons are generated through inverse Compton scattering in a more distant hot plasma. Spectral modeling confirms the presence of a soft excess, Fe Kα line emission, and a notable reflection component. Long-term RXTE/PCA data reveal evolving emission properties, including variability in the photon index (Γ) and power-law flux. The detection of both broad and narrow Fe Kα line features points to a variable broad component originating in the accretion disk (at ~ 10-5 pc) and an unconstrained narrow line. An absorption feature hints at a highly ionized region, possibly near the broad-line region (BLR). The evolving inner accretion properties of NGC 7314 suggest it may be a candidate for a changing-state active galactic nucleus (AGN).

Section:

High Energy

Poster-HE - Board: 52 / **24**

Neural Networks for Parameter Estimation of Orphan Afterglows in Rubin and Roman Data

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The Rubin and Roman telescopes will come online soon and are expected to detect over 1000 "orphan afterglows"per year: broad-band long lasting emission from a gamma-ray burst (GRB), but without the GRB. Having a method to extract the physical parameters of these orphan afterglows will give us a better understanding of the progenitor systems. We start with a model that takes physical parameters of a GRB and computes the spectra and light curves. We will use this physical model to train a neural network to emulate these results in a fraction of the time. The reduced computational costs will allow us to solve the inverse problem: getting parameters from spectra or light curves.

Section:

High Energy

Poster-HE - Board: 68 / **125**

NinjaSat Monitoring of High-Mass X-ray Binary SMC X-1

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SMC X-1 is a high-mass X-ray binary exhibiting an X-ray pulsar with a ~0.7 s spin period and a non-stationary superorbital modulation ranging from ~40 to ~65 days. Its luminosity of 5E38 erg/s makes it a local analogue of ultraluminous X-ray pulsars, powered by supercritical accretion. To investigate whether SMC X-1's superorbital modulation originates from a change in the mass accretion rate or simply from a warped accretion disk, we carried out a series of monitoring observations with NinjaSat, a 6U CubeSat in low-Earth orbit. Combining NinjaSat and MAXI data, we found no significant spin-frequency drop during superorbital low states, indicating that the source does not enter a propeller regime. Although we observe a marginal correlation between the spin-frequency residual and flux, this could be caused by sampling a single superorbital cycle within a longer-term frequency modulation. We conclude that the superorbital modulation of SMC X-1 is predominantly geometric in nature, although further observations during shallower low states, such as during the "excursion" epochs, may offer additional insights into this system.

Section:

High Energy

Poster-Solar - Board: 4 / **47**

Numerical Simulation of Gas Expansion from Meteoroid Impact Vaporization on Mercury

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Meteoroid impacts on Mercury's surface produce transient vapor plumes by releasing volatile species from surface materials. Observations by NASA's MESSENGER spacecraft have detected significant transient Na enhancements in Mercury's nightside exosphere, attributed to large-scale meteoroid impact events (Cassidy et al., 2021). Furthermore, superthermal (>50,000) Ca atoms also has been detected, indicating that these atoms could not result only from the initial impact processes. Instead, these superthermal Ca atoms are believed to originate from an additional energetic mechanism, such as the photodissociation of calcium-bearing molecules released during impacts (Killen et al., 2015). To investigate the dynamics of impact-generated gas expansion on Mercury, we will show a time-dependent Monte Carlo model. The model incorporates multiple volatile species, such as Na and CaO, and accounts for photolysis reactions. This approach aims to characterize the spatial distribution and temporal evolution of impact-generated, aiding future observations by the BepiColombo mission.

Section:

Solar System/Exoplanets

Poster-EA - Board: 43 / **137**

Observable-to-mass-and-redshift relations of galaxy clusters in RASS-MCMF and ACT-DR5 MCMF with weak lensing shear measurements from HSC

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We present weak lensing shear measurements of two ICM-selected galaxy cluster samples. The cluster samples, RASS-MCMF and ACT-DR5 MCMF, are selected by applying the Multi-Component Matched Filter (MCMF) algorithm to the second ROSAT All-Sky-Survey (RASS) source catalog (2RXS) and the ACT-DR5 dataset, respectively. For the RASS-MCMF catalog, 171 out of 8449 clusters within the redshift range $0.1 \leq z < 0.75$ are covered by the Hyper Suprime-Cam (HSC) survey, enabling weak lensing shear measurements. In the ACT-DR5 MCMF catalog, 273 out of 6237 clusters within $0.1 \leq z < 1.7$ are covered in the same HSC field. Using the measured shear profiles of these clusters, we further model the observable-to-mass-and-redshift relations.

Section:

Cosmology

Poster-Solar - Board: 2 / **39**

Observation of Lunar Impact Flashes at Lulin observatory

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The Taiwan University Lunar Investigation Project (TULIP) at the National Central University is operating a lunar impact flash monitoring system at the Lulin Observatory in the middle of Taiwan. In the last few years, several lunar impact flashes (LIFs) have been detected by two telescopes, an RC12 (30 cm) and a C8 (20 cm), mounted together on the equatorial center balance mount. The physical properties of impactors and craters on the lunar surface have been derived. In late-2024, the R-band filter was replaced by a J-band filter, together with a I-band filter, to increase the detection rates of LIFs. In this work, we will summarize the previous work and update the latest results after upgrading the new filter set.

Section:

Solar System/Exoplanets

Poster-HE - Board: 64 / **108**

Observational Connection of Radio Emissions from Pulsars with Their X-ray Properties

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Pulsars are fast-rotating and strongly magnetized neutron stars. They emit radio waves in an intense, narrow beam that sweeps across the observer. However, their radiation mechanisms have remained mysterious. This study presents the observational connection of radio emission from X-ray-emitting pulsars with their X-ray spectral properties. We found that pulsars' radio luminosity is tightly correlated with their temperature. We also show that the group of pulsars with high temperatures shows a different trend from those with lower temperatures. Analyzing their radio emission may reveal differences between pulsars with different X-ray emission properties and give a better idea of their emission mechanisms.

Section:

High Energy

Poster-HE - Board: 53 / **26**

One-dimensional three-fluid cosmic ray-plasma flows

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In the hydrodynamic approach to cosmic-ray propagation, cosmic rays and self-excited Alfven waves are considered as massless fluids. We study the three-fluid model, which comprises thermal plasma, cosmic rays and forward propagating Alfven waves. The coupling of cosmic rays to the plasma or their diffusion coefficient depends on the waves. We have classified all possible physically allowable non-uniform flows. If the diffusion coefficient remains finite even if the waves vanish, the only possible solutions are monotonically decreasing supersonic flows. On the other hand, if the diffusion coefficient becomes infinite when the waves vanish, there are two more types of flows, monotonically increasing supersonic and subsonic flows. The parameter space of allowable flows can be described analytically.

Section:

High Energy

Poster-HE - Board: 73 / **150**

Physics-Inspired Neural Network for Kilonova Modeling

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Physics-inspired neural networks (PINNs) have gained considerable importance in recent years in the domain of Astronomy & Astrophysics, particularly, being a potential tool to solve differential equations within the given boundary conditions, not limiting to accurate predictions but also providing efficient approach for large computations. In this work, we have focused on solving the kilonova equations adopted from a specific kilonova model, through direct implementation of the PINN on the differential equations and respected boundary conditions provided in the model. The PINN architecture is trained on differential equations, conditioned on certain boundary conditions, hence learning the evolution of KNe light curves based on certain ranges of physical parameters. To test the performance, after successful training, predictions of light curve for a known set of physical parameters are given as an input and comparison is made between true and predicted light curves. Current results points to stable training with significant recovery of the light curves having a low mean squared error between them. It is important to note that training and prediction of the light curves in under 2 hours. The final target for this work is to accurately predict and hence develop a PINN based KNe model that can provide light curves and perform parameter estimation under low latency.

Section:

High Energy

Poster-EA - Board: 41 / **124**

Probing Galaxy Quenching in the Early Universe through Color Gradients of Quiescent Galaxies at z > 3

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Previous studies have investigated the quenching mechanisms of quiescent galaxies at high redshift. However, due to limitations in angular resolution and sample size, the underlying processes remain poorly understood. In this study, as an initial step, we aim to explore the quenching process by analyzing the spatially resolved color profiles of quiescent galaxies at $z > 3$ using data from JWST. We will derive color gradients based on available JWST/NIRCam filters to identify radial variations within individual galaxies. By comparing these profiles across a sample of quiescent galaxies, we seek to identify the physical mechanisms responsible for the cessation of star formation in the early universe.

Section:

Galaxy/Extragalactic

Poster-SF - Board: 26 / **158**

Probing the Magnetic Field Structure of the Protoplanetary Disk in HD 163296

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The magnetic field structure within protoplanetary disks is thought to influence key processes in star and planet formation.
In this study, we aim to infer the magnetic field structure within the protoplanetary disk surrounding HD 163296, a young Class II Herbig Ae star, by analyzing archival ALMA polarization data at a wavelength of 870 μm.
Traditionally, magnetic field morphology is inferred from polarization produced by magnetically aligned dust grains. However, recent studies suggest that dust grains in such disks may have grown to sizes capable of producing significant polarization through self-scattering, complicating the interpretation.
To extract the magnetic field structure, we assume that the observed polarization arises primarily from two mechanisms: dust self-scattering and thermal emission from magnetically aligned grains. We construct a physical model of the disk using density and temperature profiles derived from previous observations. With the radiative transfer code RADMC-3D, we estimate the polarization expected from dust self-scattering, and then attribute the remaining polarization to magnetically aligned grains to infer the magnetic field structure within the disk.
Finally, we assess the consistency of our results with theoretical predictions

Section:

Star Formation

Poster-EA - Board: 40 / **123**

Pulsar Scintillation as a Probe of ISM Magnetic Fields: An Innovative Method

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The interstellar medium (ISM) is inherently non-uniform. The inhomogeneous structures on both large and small scales influence the propagation of EM waves. Theoretical studies and simulations of the ISM are typically performed on parsec-scale resolution, yet, structures on AU or sub-AU scales are not well explored. Pulsar scintillation is a powerful probe of the small scale structures utilizing pulsars as coherent sources. Scattering in underdense or overdense plasma splits the wavefront into multiple path, creating an interference pattern—manifested as modulation in intensity—shedding light on the physical properties of the obstructing small scale structure, and allowing sky mapping via VLBI.

We present a novel method to constrain an AU-scale structure's magnetic field (B-field) using polarized scintillation data. Specifically, we study a "1 ms feature"in PSR B0834+06, a 1 ms time-delayed pulse signal thought to arise from light bent at a secondary lens—referred to as the "1 ms lens."By measuring the phase difference of the 1 ms feature between right- and left-circular polarization data in the conjugate wavefield (a representation of the data), we obtain the rotation measure (RM), which enables both a measurement and an upper limit of the B-field in the 1 ms lens. Our technique offers a new way to probe RM (and thus magnetic fields) in the smallest observable ISM structures, opening a window into plasma dynamics far below the resolution of conventional methods. The 1 ms lens

is also valuable, as it acts as a telescope that enables work in cosmology and measurements of the Hubble constant.

Section:

Galaxy/Extragalactic

Poster-HE - Board: 57 / **55**

Radiation Hydrodynamics Simulations of Interacting Supernovae

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Supernovae explosion (SNe) are among the most energetic astrophysical phenomena, where the ejecta from a stellar explosion collides with a dense circumstellar medium (CSM), leading to intense shock interactions and enhanced radiation output. We employ two-dimensional radiation hydrodynamics (RHD) simulations using the CASTRO code, incorporating adaptive mesh refinement (AMR) to model the complex interaction between supernova ejecta and non- uniform CSM. Our study aims to investigate how different CSM structures affect shock propagation.

Section:

High Energy

Poster-HE - Board: 71 / **140**

Rapidly Rotating Core-Collapse Supernova Progenitors from Binary Stellar Evolution

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Rapidly rotating core-collapse supernovae are key to the formation of exotic compact objects such as magnetars and are potential sources of strong gravitational wave emission. Binary interaction offers one of the most promising pathways to spin up massive stars and endow them with high angular momentum at the point of collapse. In this study, we employ the stellar evolution code MESA to explore how binary mass ratio and orbital period affect angular momentum transfer in low-metallicity, massive binary systems. We evolve the systems through the mass transfer phase up to detachment, and subsequently follow the separate evolution of both donor and accretor stars until core collapse.

Section:

High Energy

Poster-HE - Board: 74 / **159**

Refined Localization Algorithm of the Gamma-ray Transients Monitor (GTM) on board Formosat-8B

Authors: Chih-En Wu[1]; Hsiang-Kuang Chang[2]; Chih-Hsun Lin[3]; Che-Chih Tsao[2]; Ching-Ping Hu[4]; An-Hsuan Feng[None]; Cheng-En Lo[None]; Hao-Min Chang[None]; Hong-Yi Chen[None]; Hsiang Chu[None]; Tzu-Hsuan Lin[5]; Yi-Sian Lee[None]; Yu-Hua Wang[None]; Ching-Wen Chiu[None]

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The Gamma-ray Transients Monitor (GTM) is a secondary payload on board Formosat-8B (FS-8B). It aims to monitor Gamma Ray Bursts (GRBs) and other bright gamma-ray transients in the energy range from 50 keV to 2 MeV. GTM consists of two modules, each positioned on opposite sides of the FS-8B. Each module's sensors cover half of the sky. As a result, GTM can detect signals from all directions across the entire sky. In this paper, we introduce the refined GTM Localization Algorithm, which enhances previous constraints on spectrum model parameters by simultaneously fitting both the source's location and spectrum with ad hoc simulations. In our previous localization algorithm, the whole set of different flux levels measured by each of the eight GTM detectors for a triggered event identified by the GTM Triggering Algorithm is fitted with simulated results for a GRB coming from different directions of three presumed soft, medium, and hard spectra. The best fit gives a quick result of the GRB direction and its rough spectral behavior. However, this method limited the fitted GRB spectra to a predefined set of assumed model parameters. The refined GTM Localization Algorithm incorporates the previous localization result as prior information and performs a joint fit of both the source location and spectral parameters thereby yielding more accurate localization and spectral characterization.

Section:

High Energy

Poster-SF - Board: 27 / **165**

Resolved Gas Temperatures and 12C/13C ratios in SVS13A via CH3CN and CH313CN

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Multiple systems are common in field stars and the frequency is found to be higher in early evolutionary stages. Thus, it is crucial to study young multiple systems during the embedded stages. In particular, the way material accretes from the large-scale envelope into the inner region and how this flow interacts with the system physically and chemically has not been well characterized to date. We conducted ALMA observations toward the protobinary SVS13A targeting CH3CN and CH313CN J=12-11 K-ladder line emission. We used local thermal equilibrium (LTE) radiative transfer models including dust absorption to fit the spectral features of the line emission from CH313CN and CH313CN, deriving their physical and chemical properties. We identified a possible infalling

signature toward the bursting secondary source VLA4A, which may be fed by an infalling streamer from the large-scale envelope. The mechanical heating in the binary system, as well as the infalling shocked gas, are likely to play a role in the thermal structure of the protobinary system. By accumulating mass from the streamer, it is plausible that the system experienced a gravitationally unstable phase before the accretion outburst. Finally, the derived CH313CN/CH313CN ratio is lower than the canonical ratio in the ISM and varies between VLA4A and VLA4B.

Section:

Star Formation

Poster-SF - Board: 21 / **58**

SMA 200-300 GHz Survey for Dust Properties in the Class II Disks in the Ophiuchus Molecular Cloud

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We present a SMA survey of 18 Class II sources in Ophiuchus Molecular Cloud, extending previous spectral index studies from the Taurus-Auriga region. Our observations made 8 independent samples of flux densities over the 200–300 GHz frequency range. By measuring flux densities across multiple frequency bands, we derive $\alpha_{200-300\mathrm{GHz}}$ to investigate dust optical depth and grain growth properties. Recent studies suggest that most Taurus disks exhibit $\alpha \approx 2.0$, indicating that their millimeter emission is dominated by optically thick (τ
$gtrsim5$) dust thermal radiation. If this trend holds in Ophiuchus, it implies that some previous works that were based on the optically thin assumption thus might have underestimated optical depths by at least one order of magnitude. Assuming DSHARP dust opacities, this corresponds to underestimates of dust masses by a similar factor. Intriguingly, our primarily results revealed that the spectral indices of Ophiuchus disks fall within a similar range to those in Taurus, supporting the hypothesis that dust evolution is regulated by optical depth effects rather than grain size variations alone. Population synthesis modeling will be performed to constrain maximum grain sizes (a_{max}) and dust temperatures (T_{dust}), with initial estimates suggesting that dust growth beyond the water snowline remains limited by the bouncing/fragmentation barriers. The corresponding results of this study will place new constraints on dust evolution models, maximum grain sizes, and the role of optical depth in disk structure, contributing to a broader understanding of planet formation across different star-forming environments.
The work is still on progress.

Section:

Star Formation

Poster-Stars - Board: 16 / **127**

Simulating Tidally-Locked Companions in Compact Object Binaries: Assessing the Impact of Irradiation on Dynamical Mass Measurement

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We have developed a Python tool for simulating the optical observations of tidally-locked companions in compact binary systems based on the Roche potential and the PHOENIX spectral library. The tool generates phase-resolved spectra and light curves observed from a given viewing angle. With the simulations, we aim to investigate the impact of the irradiation effect on the observed radial velocity curves, and assess the potential biases introduced in binary mass measurements.

Section:

Stars/Star Clusters

Poster-Solar - Board: 11 / **164**

Spectroscopic observation on Helley-type comet 12P/Pons-Brooks

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We present our time-series spectroscopic observation of comet 12P/Pons-Brooks using the LISA spectrograph mounted on the Lulin One-meter Telescope. The data were obtained between 25 November, 2023 and 24 March 2024, with heliocentric distances from 2.463 to 0.941 au at the pre-perihelion epoch. We clearly detected the emission features of CN, C_2, C_3, NH_2, and OI, and estimated the production rates of these minor chemical species by adopting the Haser's model. Our observation provides a valuable record of the evolution of coma gas abundance over time of 12P/Pons-Brooks.

Section:

Solar System/Exoplanets

Poster-Facilities - Board: 87 / **86**

Status Report on AO Development at TARA

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We have initiated the development of key adaptive optics (AO) technologies in Taiwan. Our current efforts include simulating atmospheric turbulence based on the Kolmogorov model and conducting simulations of Shack-Hartmann wavefront sensors (SHWFS). We are actively developing and testing

wavefront reconstruction algorithms, along with a real-time interface for acquiring SHWFS data and performing wavefront correction. In parallel, we are building capabilities for deformable mirror (DM) control, covering both hardware operation and software integration.

This work lays the groundwork for Taiwan's future AO developments. To gain experience with 10-meter class telescopes, we are collaborating with the Subaru ULTIMATE AO team. We are also planning to participate in a project on turbulence profiling and system integration for AO-assisted satellite optical communication—an initiative that expands AO applications beyond astronomy.

In this talk, I will present the current status of our work and outline future plans for AO development in Taiwan.

Section:

Facility Program

Poster-Facilities - Board: 86 / **15**

Status of ALMA Project and Wideband Sensitivity Upgrade

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The Atacama Large Millimeter/submillimeter Array (ALMA) has been providing continuous observations since 2011. To date, ALMA has carried out nearly 5,000 observing projects, contributing to more than 4,000 journal papers. This report presents an update on the current status of ALMA, with a particular focus on Taiwan's participation in the project and the role of the ALMA Regional Center (ARC) Taiwan node. Additionally, we will discuss the ALMA development roadmap, which was released in 2018 to guide future upgrades. A key initiative, the ALMA2030 Wideband Sensitivity Upgrade (WSU), aims to at least double ALMA's observing bandwidth, significantly enhancing its capabilities. We will provide a brief overview of the progress and current status of this upgrade.

Section:

Facility Program

Poster-HE - Board: 58 / **61**

Stellar Mass Black Hole Formation from Magnetized Core-collapse Supernova Simulations

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Core-collapse supernovae (CCSNe) are the birthplace of neutron stars and stellar-mass black holes (smBH), albeit the exact explosion engine(s) remain elusive. Observationally, magnetized CCSNe have been linked to long gamma-ray bursts and magnetars. In this project, we investigate the

magneto-hydrodynamics and rotational effects on core-collapse supernova dynamics and multimessenger signals for a 40 solar mass progenitors via two-dimensional self-consistent CCSN simulations with neutrino transport. Our simulation results reveal four distinct morphologies: failed supernovae with smBH formation, neutrino-driven explosions, monopolar jet-driven explosions, and bipolar jet-driven explosions. We find that rotation can significantly delay black hole formation in failed CCSNe, while magnetic fields can aid in their successful revival. In addition, gravitational wave signals show that magnetized neutrino-driven models resemble pure hydrodynamic models, whereas jet-driven models exhibit stronger protoneutron star oscillations.

Section:

High Energy

Poster-Stars - Board: 17 / **146**

THE EVOLUTION OF TYPE IA SUPERNOVAE WITH THEIR EJECTA VELOCITIES

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Type Ia supernovae (SNe Ia) play a central role in cosmology, yet increasing evidence suggests they are not a fully uniform population. While most studies of SN ejecta velocities are from the Si II λ6355 absorption line, the Ca II H&K feature—likely formed in the different layers of SN ejecta—may offer a different perspective on explosion dynamics and progenitor diversity. In this study, we investigate how Ca II H&K velocities vary with different parameters, such as redshift, pseudo-equivalent width (pEW), and host galaxy environment, comparing them to trends observed in Si II velocities across multiple SN Ia samples (DES, PS1, SDSS, and SNLS). Our objective is to determine whether Ca II H&K can reveal additional diversity or trends not evident from Si II alone and to assess its potential as a complementary probe in understanding SN Ia physics.

Section:

Stars/Star Clusters

Poster-Solar - Board: 8 / **133**

Temporal Variability of SO and NaCl in Io's Atmosphere Observed through the Submillimeter Array

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Io, Jupiter's most volcanically active moon, has a dynamic atmosphere primarily composed of sulfur dioxide (SO_2). Minor atmospheric components, such as sulfur monoxide (SO), sodium chloride (NaCl), and potassium chloride (KCl), are likely produced by volcanic outgassing. Some SO also originates from the photodissociation of SO_2. These components serve as indicators of atmospheric processes and volcanic activity. Our study aims to investigate the temporal variability of these minor species using three tracks of SMA observations obtained in 2022 to gain a better understanding of their sources, sinks, and roles in Io's atmospheric dynamics. We consistently detected three SO lines across all three observation tracks. NaCl was detected on two of the three observation days, while KCl remained below the detection threshold. We will derive the column densities through

radiative transfer analysis and compare them with the simultaneous SO_2 measurements. The relative abundance ratios between SO and SO_2 will provide further insights into distinguishing the sources between direct volcanic release and secondary production through atmospheric chemistry. Additionally, the variability in NaCl detections suggests that there may be temporally or spatially localized volcanic activity.

Section:

Solar System/Exoplanets

Poster-SF - Board: 25 / **75**

The Highly Collimated SiO Protostellar Jet from the Class 0 Protostar HH212

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HH212 is a nearby protostellar jet driven by a Class 0 protostar (IRAS 05413–0104), exhibiting a symmetric structure with knots. The Atacama Large Millimeter/submillimeter Array (ALMA) has observed the SiO J = 16–15 line in Band 9 with a resolution of 0.088″ × 0.067″, and the J = 8–7 line in Band 7 with a higher resolution of 0.022″ × 0.020″. By comparing the intensities of the two lines—after convolving them to the same resolution—it is possible to estimate the average temperature and density of the collimated jets. Assuming uniform physical conditions, a simple model is developed to describe the jets and to compare with the observed line ratios. This approach provides relatively direct insights into the physical properties of the inner jets, offering a deeper understanding of the innermost structures of a protostellar system.

Section:

Star Formation

Poster-SF - Board: 19 / **51**

The Magnetic Field in Star-Forming Regions of the Perseus Molecular Cloud

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To understand the influence of magnetic fields on star formation processes, we estimated the magnetic field strength in IC348, L1448, L1455, NGC1333, and B1 of the Perseus molecular cloud using the Davis-Chandrasekhar-Fermi (DCF) method and its modified approaches. The angular dispersion was derived from 850~μm polarization data observed by the JCMT, while velocity dispersion was

measured from N_2H^+ (1-0) and NH_3 (1,1) spectral lines observed with the NRO and the GBT, respectively. The average plane-of-sky magnetic field strength calculated by the DCF method is around a few hundred μG, consistently higher than those obtained using the modified methods. Nevertheless, the observed mass-to-flux ratio with all the methods show a transition from subcritical in filaments to supercritical in the cores, suggesting that cores initially form in subcritical environments before evolving into supercritical ones. In addition, all regions exhibit sub-Alfvénic or trans-Alfvénic conditions, indicating that magnetic fields dominate over turbulence. Although these results may reflect our selection criteria in angular dispersion measurements, which exclude regions with large perturbations in polarization angles, the excluded area is only 17.5 % of the core regions with column density larger than $\sim 4\times10^{22}$ cm^{-2}. To assess the relative importance of magnetic fields, gravity, and turbulence, we also calculated these energies for prestellar and protostellar cores. Our results show that the proportion of gravitational energy is higher in the denser regions traced by NH_3. These findings align with the ambipolar diffusion model, indicating a weakening magnetic field and increasing gravitational dominance toward core centers.

Section:

Star Formation

Poster-HE - Board: 75 / **163**

The Orbital Period Evolution of X2127+119 in Globular Cluster M15

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X2127+119 is a dipping low mass X-ray binary system located at the globular cluster M15 with an orbital period of 0.713 day. To refine the orbital ephemeris, we analyzed the light curves collected by HEAO-1, EXOSAT, Ginga, ASCA, BeppoSAX, XMM-Newton, RXTE, Chandra, and MAXI, with a total time span of 47 years from 1977 to 2024. The orbital modulation profiles, obtained by folding the light curves with the linear ephemeris proposed by Homer et al. (1998), exhibit a clear dip and marginal partial eclipse feature. A significant drift in the evolution of dip minimum phases can be observed, indicating that the orbital period needs updating. A linear model fit applied to the phase evolution yields a revised orbital period of $0.71302139(32)$ days. Furthermore, a quadratic model was also applied to assess any significant changes in the orbital period over time. However, in comparison to the linear fit, the F-test results in a p-value of 0.3, suggesting no obvious improvement with the quadratic model. We therefore conclude that the orbital period has remained stable over the 47-year time span, with a 2σ upper limit of$\dot{P}/P < 2\times10^{-7-1}$ for orbital period derivative.

Section:

High Energy

Poster-EA - Board: 45 / **148**

The Stellar Mass Function of Galaxy Clusters in the eROSITA Final Equatorial Depth Survey

Author: Wen-Chi Hua[1]

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In this project, our goal is to measure the stellar mass function of galaxy clusters selected in X-rays in the eROSITA Final Equatorial Depth Survey (eFEDS), which is the deepest X-ray survey over a contiguous footprint.
The sample consists of galaxy clusters spanning a mass range of $10^{13}\,h^{-1}M_{\odot} \leq M \leq 10^{15}\,h^{-1}M_{\odot}$, and a redshift range of $0.1 < z_{\rm cl} < 1.2$.
We use photometric data from the WISE W1 band at 3.4 μm, as it lies near the peak of the blackbody radiation curve for galaxies dominated by old stellar populations. The full-sky coverage of WISE also enables us to extend our measurements from the eFEDS sample to upcoming all-sky cluster catalogs. As a first step, we used the WISE galaxy catalog to measure the magnitude distributions of eFEDS clusters and performed masking corrections. In parallel, we derived metallicities from a metallicity–luminosity relation, and constructed red-sequence models by interpolating the metallicity onto a grid of composite stellar population (CSP) models. From these models, we obtained the corresponding mass-to-light ratios, which enables the stellar mass estimates of the cluster sample. In this meeting, we will present our preliminary results.

Section:

Cosmology

Poster-EA - Board: 35 / **91**

The X-ray Absorption by the Interstellar Medium in Active Galaxies

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Statistical X-ray AGN studies show that the fraction of obscured active galactic nuclei (AGN) increases towards the early universe, indicating that most of the supermassive black hole (SMBH) growth occurs behind large amounts of gas and dust. Models of AGN obscuration by a dusty torus cannot simply account for the increased fraction of absorbed sources, indicating additional obscuring structures surrounding the SMBH. Since galaxies in the early universe have a larger gas fraction and smaller size for the same stellar mass compared to the local universe, it suggests that the evolution of host galaxy interstellar medium (ISM) may be behind the increased fraction of obscured AGN. Since X-ray observations alone cannot distinguish between the gas associated with the AGN structure or the interstellar medium, we use sub-mm observations of the cold dust continuum to estimate the gas mass of more than 100 AGN host galaxies within the survey area of the COSMOS-Web survey. Thanks to the high angular resolution of JWST, we infer the spatial size of the gas mass based on the empirical relationship between sizes of gas and stellar distributions, allowing us to estimate the gas density and Hydrogen column density without relying on resolved CO observations. Here we present our preliminary results on the instance of absorption by the host galaxy ISM among the sample of X-ray detected AGN within the COSMOS-Web region.

Section:

Galaxy/Extragalactic

Poster-EA - Board: 32 / **57**

The effect of dust evolution on the multi-phase interstellar medium

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The interstellar medium (ISM) is fundamental to star formation and galaxy evolution, with dust serving as a pivotal regulator of various astrophysical processes. Yet, the mechanisms driving dust evolution in stellar feedback–dominated environments remain elusive. While photoionization feedback from massive stars—responsible for generating HII regions and reshaping the ISM's structure and chemistry—is widely acknowledged, its specific impact on dust survival, sputtering, and redistribution is far less understood than that of supernova-driven shocks. Recent observational evidence highlighting pronounced spatial variations in dust properties challenges conventional wisdom and invites further scrutiny.

In this study, we employ the GIZMO code to simulate the intricate interplay between dust growth, photoionization, and chemical evolution. Our goal is to disentangle and quantify the distinct contributions of photoionization to the thermal structure, chemical composition, and spatial distribution of dust within the ISM. By questioning established paradigms and embracing innovative computational strategies, our research offers a forward-looking perspective on how stellar feedback mechanisms drive dust processing—and, by extension, galaxy formation—in diverse cosmic environments.

Section:

Galaxy/Extragalactic

Poster-Facilities - Board: 88 / **145**

The software development for the TP2m telescope

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The Trans-Pacific Two-Meter Telescope (TP2m) is a collaborative project between NCU, ASIAA, UNAM, SHAO, UNAM, and HNAS. The telescope is expected to be deployed in San Pedro Mártir, Mexico, around 2025. The TP2m's will collaborate with the nearby COLIBRI 1.3m telescope, and its primary scientific focus is on transient targets.

We aim to develope the telescope control system for the TP2m to enable remote, automated, and robotic operation. In this presendation, we will share our latest progress.

Section:

Facility Program

Poster-EA - Board: 33 / **69**

Tracing Gas and Star formation in Galaxy Mergers with ALMA and MaNGA

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Galaxy interactions play a crucial role in the evolution of galaxies in the local universe, often triggering enhanced star formation. Simulations consistently suggest that such interactions significantly reshape the distribution of molecular gas within galactic disks, thereby altering the spatial distribution of star formation. In this study, we aim to observationally investigate the distribution of gas and star formation across different merger stages and assess the extent to which these observations align with simulation predictions.
We analyze a sample of 15 galaxies—including galaxy pairs and post-mergers—with stellar masses $\log(M^*) \geq 10$ [M⊠] and redshifts in the range $0.02 < z < 0.1$, using data from ALMA and SDSS-MaNGA. We construct radial profiles of gas fraction, star formation rate (SFR), and star formation efficiency (SFE) extending from the galactic center to 1.5 effective radii (Re). These profiles are then compared with those of main-sequence (i.e., non-interacting) galaxies from previous studies.
Our results indicate that the gas fraction is the primary driver of elevated SFR in interacting galaxies, while SFE plays a more limited role—particularly in post-merger systems. Nevertheless, galaxies across all merger stages show a consistent relationship between SFR and SFE, suggesting the presence of a common regulatory mechanism governing star formation during galaxy interactions.

Section:

Galaxy/Extragalactic

Poster-Solar - Board: 10 / **153**

Truncated Power Law Embedded in Mass Distribution of Geminids Using Gaussian Statistic

Author: YIPING CHEN[None]

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This study uses the Gaussian distribution function model to find the mass index of the meteor. We use the observations and the meteor melting formula to calculate the meteor mass m, and then analyze the correlation between m and the number of meteors to find the mass index of the meteor shower of the Geminids.
In the past, the mass index was obtained through repeated calculations. Our research has found that when the cumulative number of meteors is plotted against the logarithm of the meteor mass, it will be similar to the error function graph of the Gaussian distribution. Therefore, we want to use the function model of the Gaussian distribution to try to simulate the mass distribution of the meteors. We use the chi-square test and the Kolmogorov test to test whether the function model of the Gaussian distribution is suitable for the meteor mass, and then use this function model to find the mass index of the meteor.
Finally, we will use this model to determine the mass index of the meteor and using this model to analyze meteor mass for others constellation in the future.

Section:

Solar System/Exoplanets

Poster-SF - Board: 23 / **67**

Turbulence modes and molecular cloud evolution in M33

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Turbulence modes and molecular cloud evolution in M33

The nature of turbulence in molecular clouds is one of the driving factors that influence the efficiency by which the gas is converted to stars. In the Milky Way, it is speculated that the high star formation efficiency observed in spiral-arm clouds is linked to the prevalence of compressive curl-free) turbulent modes in the motion of molecular gas, while the shear-driven solenoidal (divergence-free) modes appear to be the main cause of the low star formation efficiency that characterizes clouds in the Central Molecular Zone. We proved the inverse proportionality between the solenoidal and the star formation efficiency in the plane molecular clouds in the Milky Way in the CHIMPS survey and, in addition, that the solenoidal modes decrease with a shallow gradient with the distance from the centre of the Galaxy. This shallow gradient is unaffected by the presence of spiral arms. In this investigation, we perform a similar analysis of turbulence on a sample of clouds spanning all galactic environments in the Triangulaum galaxy (M33). At a distance of 840 kpc with its nearly face-on inclination, M33 is an ideal target to probe how large-scale mechanisms affect gas motions in giant molecular clouds, thus impacting the clouds' evolutionary state and star forming efficiency. Using ACA and ACA+IRAM observations of 13CO(2-1) and 12CO(2-1) molecular lines, we explore how solenoidal turbulence varies with galactocentric distance and within various galactic features. We then compare the star-forming properties of the clumps (evolution quantified by the amount of HII emission) and their location to the amount of power in the solenoidal modes of turbulence.

Section:

Star Formation

Poster-EA - Board: 34 / **80**

Unearthing the Hidden: Number Counts of Dusty Galaxies below Noise

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The cosmic infrared background (CIB) originated from reprocessed dust emission after dust in galaxies absorbs the UV light from young massive stars and accreting supermassive blackholes. Resolving the diffuse CIB into individual galaxies provides insights into the cosmic star-forming activities that are obscured at the optical wavelength. Previous studies have constructed number counts of bright sources detected at 450 μm, but these galaxies account for only around 40% of the total CIB at this wavelength. To advance this study, we aim to estimate the CIB contribution from faint 450 μm sources undetected in deep 450 μm images.
We utilized data from the JCMT STUDIES (SCUBA-2 Ultra Deep Imaging EAO Survey) program in the COSMOS field, the deepest ever 450 μm imaging, along with galaxy catalogs at 4.5 μm from Spitzer and JWST to probe faint sources. We used a stacking analysis approach to measure the average 450 μm flux from more than 10000 faint 4.5 μm galaxies and carried out the simulation of sources

at random positions to subtract the mean background. We also accomplished simultaneous stacking and deblending to account for biases caused by source clustering at scales similar to the instrumental beam size. After the mean background subtraction, we obtained an average flux of 0.27±0.02 mJy for the 4.5 μm galaxies, closely matching the prediction based on the extrapolation of the number counts of brighter sources. By adding the integrated surface brightness of these faint galaxies to the contribution from brighter sources, we obtain a total surface brightness of 112.4 Jy/deg^2, recovering approximately 84% of the CIB measured by COBE and Planck. Preliminary results from deblended stacking suggest that this method can effectively correct for flux overestimation caused by instrumental confusion and source clustering, so we expect to further refine our measurement on the faint source contribution to CIB.

Section:

Galaxy/Extragalactic

Poster-EA - Board: 30 / **41**

Unveiling HI and Gas-PAH Relations at Sub-kpc Scales: A VLA Perspective

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Co-authors: Adam Leroy [2]; Eric Koch [3]; Karin Sandstrom [4]

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Recent studies with JWST and ALMA have revealed an almost-linear scaling relation between mid-infrared polycyclic aromatic hydrocarbons (PAHs) and CO J=2-1 (tracing H2) emissions at hundred-parsec resolution. This scaling relation could be a powerful tool for studying neutral gas structure within molecular clouds. However, whether this gas-PAH relation holds in atomic-gas-dominated environments remains unclear due to the spatial resolution and sensitivity of existing HI data. To advance our understanding of the gas-PAH relation across different phases of the ISM, we conducted observations of HI 21-cm emission in 4 PHANGS-JWST Cycle 1 galaxies: NGC628, NGC1087, NGC3627 and NGC4254. These galaxies possess extensive ancillary data, including JWST F335M, F770W and F1130W PAH emission, along with filters necessary for continuum calculation. Using the VLA B+C+D configurations (total observing time ~45 hr per galaxy), we produced new HI data cubes with ~7"beam sizes, ~5.5 K sensitivity, and 2.1 km/s spectral resolution, processed through the PHANGS imaging pipeline. Our preliminary results indicate that at ~7"scales, PAH emission strength scales with gas surface density across both atomic- and molecular-gas-dominated phases of ISM. The normalization of this scaling appears to depend on the H2/HI ratio, indicating a preferential mixture of PAHs with molecular gas over atomic gas. These findings offer new insights on how JWST observations can be leveraged to trace ISM gas structures.

Section:

Galaxy/Extragalactic

Poster-EA - Board: 39 / **119**

Using Cross Correlation Functions to Constrain the Host Environment of Fast Radio Bursts

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Fast Radio Bursts (FRBs) are millisecond-duration radio wave transients that emit enormous energy with unknown origins. In this project, we aim to constrain the environment of galaxies hosting FRBs by measuring their cross correlations with other populations of galaxies. To explore the methodology, we construct realistic mock catalogs of FRBs and galaxies using a semi-analytical method.
To start with, we employ halos from N-body simulations in Takahashi et al. (2018). We then populate galaxies of these halos with the stellar mass and star-formation rate using the latest HOD model from the COSMOS survey in Weaver et al (2023). Two mock FRB catalogs are constructed using different mechanisms: One is the FRB rate proportional to the stellar mass of the host galaxies, representing a scenario that FRBs typically take place in old stellar populations. The other is the opposite case, where FRBs primarily occur in young stellar populations and their production rate is proportional to the star formation rate of host galaxies. The mock FRBs follow the energy distribution measured in Shin et al (2023). The dispersion measure (DM) of the mock FRBs is predicted from Macquart relation.
We will present the preliminary results in this poster.

Section:

Galaxy/Extragalactic

Poster-Stars - Board: 13 / **31**

Validating the Reliability of Distance Estimation Using RR Lyrae gri-Band Period-Luminosity-Metallicity Relations

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We compared several empirical period-luminosity-metallicity (PLZ) and period-Wesenheit-metallicity (PWZ) relations of RR Lyrae stars to evaluate their validity and precision in distance estimation. Our analysis used data from various observations and surveys of the Large Magellanic Cloud as benchmarks. We further investigated intrinsic factors contributing to discrepancies among the empirical relations. A detailed analysis of RR Lyrae PLZ/PWZ relations can help reduce distance estimation biases in future surveys, including LSST and others equipped with Sloan-like filters.

Section:

Stars/Star Clusters

Poster-GW - Board: 78 / **157**

Where There's a Wave, Bayestar leads the way. Sky Localization of Gravitational Wave

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Low-latency searches are crucial for Multi-Messenger Astronomy (MMA), where gravitational waves help us to quickly locate where events happened and promptly inform other telescopes to conduct follow-up observations. Gravitational waves, like ripples in space and time, are generated by the mergers of massive compact binaries such as binary black holes, binary neutron stars, and neutron star-black hole binaries. These waves propagate outwards from the events. They could be detected by the observatories (Ligo, Virgo, and KAGRA) when they reach Earth. This study uses the rapid Bayesian sky localization tool Bayestar to analyze gravitational wave events originating from Binary Neutron Star (BNS) events. We aim to investigate the impact of using data from different gravitational wave detector network configurations on the precision of sky localization.

Section:

Cosmology

Poster-HE - Board: 63 / **103**

XMM-Newton and NuSTAR observations of the redback millisecond pulsar PSR J2215+5135

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We present a follow-up X-ray study of the redback millisecond pulsar PSR J2215+5135. PSR J2215+5135 was discovered as a radio pulsar with an orbital period of 0.17 day. It is in a compact binary system with a low-mass companion of 0.33 $M_{\odot}$ (Linares, et al., 2018).
Observationally, redback systems occasionally exhibit a double-peaked structure in their X-ray light curves. This phenomenon could be explained by an intra-binary shock with Doppler boosting (Sullivan & Romani, 2024). The intra-binary shock arises from the interaction between the pulsar wind and stellar wind from the companion (Takata, et al., 2012).
We analyze the latest *NuSTAR* observations of PSR J2215+5135 in 2024 in the 3-79 keV band, along with the older *XMM-Newton* observations between 2016 and 2022 in the 0.2-10 keV band. Our timing analysis confirmed the existence of a double-peaked profile in both *XMM-Newton* and *NuSTAR* light curves. X-ray emission up to about 40 keV is detected, and the joint spectrum can be modeled with a power-law plus a neutron star atmosphere model. At a distance of 3 kpc, the 0.2-79 keV luminosity is 1.03×10^{33}erg s^{-1}. A spectral change has also been observed in the phase-
resolved spectrum, indicating variability in the shock region.

Keywords: binaries: close, pulsars: individual (PSR J2215+5135), X-rays: binaries

References:
Linares, M., Shahbaz, T., & Casares, J. 2018, APJ, 859, 54

Takata, J., Cheng, K. S., & Taam, R. E. 2012, APJ 745, 100
Sullivan, A. G., & Romani, R. W. 2024, APJ, 974, 315

Section:

High Energy

Poster-EPO - Board: 83 / **154**

《不是那種天文學：從星空到 debug/Astronomy, But Not What You Think: Mandarin astronomy education podcast for general public》

Authors: Sy-Yun Pu[1]; Yung Hsuan Tseng[2]; Zi-Hua Ho[3]

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即使在資訊爆炸的時代，天文學仍常被誤解、浪漫化，甚至神秘化。為了拉近研究者與大眾之間幾億光年的距離，我們開始製作 Podcast 節目《不是那種天文學 Astronomy, But Not What You Think》。

我們是一群天文研究的見習生，也曾是清華天文社的正副社長。我們曾經兩度參加國科會創意科普影片競賽，分別獲得金獎與創意獎，並持續探索用創意說天文的可能。Podcast 是我們延續熱忱的新形式，也是目前中文世界中相對稀少、專注於研究議題的天文科普聲音。節目從大眾對天文的疑問出發，延伸至介紹實際研究的知識、觀測與理論背後的故事，以閒聊、訪談或是新聞討論等節目形式，破除常人對天文的浪漫誤解。我們希望這個節目不只推廣天文，更是一種邀請：歡迎更多天文人參與科普、打開對話，用自己的方式，讓科學被更多人看見與聽見。

Astronomy is often misunderstood or overly romanticized by the public. To help close the gap between researchers and general audiences, we launched a Mandarin-language podcast: Astronomy, But Not What You Think.

We are a group of astronomy graduate students and the former president and NTHU Astronomy Club vice president. In the past, we received the High Distinction Award and the Creativity Award in the NSTC's Open Call Popular Science Short Film Competition. This podcast continues our effort to communicate astronomy in creative and accessible ways. Each episode starts with a common question and connects it to real scientific topics, including observations, theory, and current research. With formats like casual discussion, interviews, and commentary on astronomy-related news, we aim to make astronomy more relatable and accurate.

We hope this project encourages more researchers to engage with science communication in their own way, and to make astronomy more visible in the broader public sphere.

Section:

Outreach and Education

Poster-EPO - Board: 81 / **70**

天文教育新思維–強化天文和生活元素的連結

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南瀛天文館為天文教育帶來嶄新的面貌。透過展示館更新工程，我們將展示的焦點從傳統的物件展示解說，轉移至以「學習者」為中心的生活之中，不再停留在課本知識的重現，而是著重讓參觀者體驗到天文和生活元素的連結。從食衣住行等面項，使天文的學習更貼近生活。

Section:

Outreach and Education

Poster-EPO - Board: 82 / **78**

平方反比律與重力高斯定律探討

Author: Rui-Zhen Wang[1]

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距離平方反比律適用於四大基本作用力之中的重力和電磁交互作用力, 這奇妙的比例甚至引起以從事理論工作聞名的電磁學理論大師馬克士威 (J. C. Maxwell) 的技癢, 對二次方進行精確度實驗, 結果證明可以準確到小數點以下 4 位. 是一個簡單的整數 2, 而不是近似 2 的實驗參數. 對於背後的物理模型, 在電磁學中則是廣為人知的高斯定律, 高斯定律是將靜電庫倫定律解釋成電 (或磁) 通量均勻分布到球對稱的封閉面上, 而電 (或磁) 場強度即等於電 (或磁) 通量線的球面密度, 由於電 (或磁) 通量線是與距離無關的守恆量, 而球面積則正比於距離平方, 因此場強等於通量的球面密度便與距離平方成反比. 即所謂的高斯定律, 屬於電磁學馬克示威方程式之一.
而在重力理論中, 理論力學的發展從牛頓萬有引力定律之後主要是廣義相對論的發展, 數學架構是以時空架構為主, 一般並不討論重力場通量.
近年來, 暗物質問題引起理論物理學家的意見紛歧, 關於包含所謂盤狀星系的平坦旋轉曲線現象, 目前的主流理論是維持牛頓的平方反比律而假設是暗物質的存在造成過量重力的現象, 然而也有一部分學者提出修正牛頓理論的模型, 因此平方反比律的來龍去脈也是一個重力學中值得探索討論的課題, 例如很容易可以證明, 柱狀對稱的場通量分布便可以得出場強與距離一次方成反比的關係以及非傳統克普勒定律的距離正比於週期一次方的關係, 也就是相當於所謂平坦的速度-距離旋轉曲線關係.
藉由高斯定律的審視與推廣的可能性的討論, 我們可以對暗物質課題提出另一種純粹重力學的模型同時也對距離平方反比律有更全面的理解.

Section:

Outreach and Education

Poster-EPO - Board: 80 / **36**

臺北天文館天文教育活動簡介

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臺北市立天文科學教育館天文活動介紹。

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Outreach and Education