中華民國天文學會 2008 年研討會論文摘要
Abstracts of ASROC Symposium 2008

Scientific Oral Presentations/論文宣讀

Feedback in Astrophysics: X-Ray Cooling Flows

Jeremy Lim
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ABSTRACT
Feedback in astrophysics usually involves a self-regulating process whereby a phenomenon A that caused B is itself adversely affected by the effect of B back on A. Feedback can be found in a broad variety of astrophysical situations, a simple example being star formation: in a molecular cloud forming stars, the newly-formed stars disrupt the molecular cloud thereby reducing its ability to form other stars. Here I briefly review the subject of X-ray cooling flows, a phenomenon first proposed 30 years ago: catastrophic cooling of the hot X-ray-emitting gas in which galaxy clusters are immersed should result in a vigorous inflow of cool gas to the cluster center. I describe the eventual recognition that feedback from an AGN in the central dominant cluster galaxy can reduce if not entirely quench the cooling flow. Although in this picture cooling flows are posited to fuel the AGN, material accreted through interactions or mergers with cluster galaxies is a viable alternative; the latter removes the need for feedback, and therefore any cooling flow. From observations of the Perseus Cluster, the closest putative strong cooling-flow cluster, I show that X-ray cooling flows genuinely do occur, and that the measured cooling-flow rate in this cluster is about an order of magnitude smaller than what was originally predicted.

Probing Dark Matter Subhalos

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ABSTRACT
Most of the mass in the universe is in the form of unobservable dark matter (DM). The existence of DM manifests itself only through its dominant gravitational attraction on visible matter or light. The true nature of the DM is still unknown; however, it is usually assumed that the DM is mainly constituted by weakly interacting massive particles (WIMPs). The typical mass of the DM particle is generally believed to be around tens GeV to several TeV, but light particles with mass around 1-100 MeV is also possible. Recent simulation indicated that there must be lots of small sub-halo structures formed from the collapse of the DM as well as the large-scale structures of the universe. However, observations did not reveal such sub-halo structures as simulations indicated; this is known as the missing satellites problems. In this talk, I will discuss the observable properties of these dark sub-halo structures and argue that these dark subhalo might be detectable with current available instruments. I will then discuss how to detect and identify these dark subhalos.

Where is Obscuring Torus? -- 10 pc Resolution Imaging of Molecular Gas around the Seyfert 2 Nucleus of M51

Satoki Matsushita, Jeremy Lim, and Sebastien Muller
ASIAA

ABSTRACT
Previous molecular gas observations at arcsecond-scale resolution of the Seyfert 2 galaxy M51 suggest the presence of a dense circumnuclear rotating disk, which may be the reservoir for fueling the active nucleus and obscures it from direct view in the optical. We carried out CO(2-1) line observations of the nuclear region of M51 with the A configuration of the IRAM Plateau de Bure Interferometer, yeilding to spatial resolution lower than 15 pc. The images show no clear evidence of disk structure as suggested by previous observations. The emission at the western side of the nucleus shows an elongated structure along the radio jet, and likely originates from gas entrained by the jet. The emission at the eastern side of the

nucleus is elongated toward the nucleus, and shows a velocity gradient blueshifterd toward it, which is an opposite sense as the previously published results with much larger beam size. Possible explanations for the observed distribution and kinematics of the nuclear molecular gas are that a rotating gas disk disturbed by the jet, a streaming gas toward the nucleus, or the disk with another smaller conter- or Keplarian-rotating gas disk inside.

On the Driving Forces of the Star Formation Rate in Galaxy Pairs

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ABSTRACT
During the past few years, various studies have suggested that starburst can be usually induced by interaction of close pairs of galaxies, the mass ratio and the separation between galaxies in a close pair can especially play an important role on triggering star formation rate (SFR). On the other hand, the effect of environments of these interacting galaxies on SFR still remains inconclusive, and there are even discrepancies between different studies. To systematically investigate this interesting but yet unclear relation between SFR and environment, we have analyzed the correlations between SFR and other physical properties of galaxy pairs selected from the Millennium Run (MR) output, and our analysis suggests the SFR of the MR galaxy samples is inversely proportional to the surrounding galaxy number density within 1 Mpc radius. To verify this intriguing result, we combine the simulations with observational data for a further study. These data, including ultraluminous infrared galaxies (ULIRG) from IRAS and interacting galaxies observed by Spitzer, are compiled from literature with available information of both mass ratio and member galaxy separation; the environmental parameter of each galaxy pair, namely the neighborhood galaxy density, is measured from the database of Sloan Digital Sky Survey (SDSS). With the joint analysis of simulations and observational data, we finally provide a quantitative comparison of the star formation efficiency enhancement simultaneously driven by mass ratio, separation, and environments.

Current Status of 2-m Telescope Construction Project

Kinoshita Daisuke and 2-m telescope construction project team
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ABSTRACT
We are constructing a 2-m telescope at Lulin observatory in Taiwan. The main objective of this facility is to conduct intensive follow-up observations for new discoveries by Pan-STARRS PS1 sky survey. The design of the telescope was completed by the end of 2007. The design of the enclosure and pillar is expected to be completed in May 2008. The primary mirror is being built in Russia now, and the expected delivery date is March 2009. We report the current status of 2-m telescope construction. In addition, we also introduce our instrumentation program. After the approval of our funding request at the end of 2007, we started the instrumentation program for 2-m telescope. We give the conceptual design of the 4-color simultaneous imager. The dichroic mirrors split the beam, and signals at four different bands are recorded exactly at the same time. This enables us accurate color measurements by canceling sky condition changes. The use of fully depleted CCDs provides high quantum efficiency at longer wavelength, say 0.6 or more at 1 micron, and negligible fringe pattern. These advantages open new window for observing by a small telescope at y-band.

The Latest Status of the ALMA Project

Nagayoshi Ohashi, and ALMA-Taiwan Team
ASIAA

ABSTRACT
Since 2005, Taiwan has participated in the Atacama Large Millimeter/Submillimeter Array (ALMA) project, the largest ground based astronomical project ever carried out. The array is now under construction in the Chajnantor area in the Atacama desert in northern Chile. The ALMA project has three major international partners: North America, Europe, and Japan. The North American and European partners are responsible for the construction of the 12m Array (ALMA-baseline project), while Japan is

responsible for the construction of the Atacama Compact Array (ACA; ALMA-Japan project). Taiwan has been participating the ALMA Project through ALMA-Japan. Additional cooperation with ALMA-NA (North America) is under the final negotiation. ALMA will be completed in 2012, and its expected lifetime is at least 50 years.

The ALMA construction is moving forward: as of April 2008, ALMA-Japan has constructed all the four 12 m antennas for the system of Atacama Compact Array (ACA) at the ALMA Operation Support Facility (OSF) in Chile, and the first light has been obtained with two of them. ALMA-North America has also constructed four 12 m antennas for the main array system. The first ALMA Front-End subsystem has been delivered to OSF, which will be installed into one of these antennas. In Taiwan, as a part of ALMA-Taiwan activities, the East Asian Front-End Integration Center (EA-FEIC) has started partial operation. EA-FEIC will assembly, test, and ship to Chile all the receivers for the ACA system. Furthermore, the development of the SIS junctions for the ALMA highest frequency band, Band 10, has been carried out jointly with ALMA-Japan. In addition to such technical projects, ALMA-Taiwan has been also discussing how to support the ALMA local users in Taiwan. More importantly, actual scientific programs Taiwan would like to carry out using ALMA in near future have been intensively discussed among the ALMA-Taiwan science team and potential users.

In my presentation, I will show the latest status of the ALMA project, with an emphasis on activities ALMA-Taiwan has been carrying out.

AzTEC/ASTE Wide-Field Imaging Observations toward Chamaeleon Molecular Cloud at λ=1.1 mm

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ABSTRACT
What determines the stellar initial mass function (IMF) is one of the classical but still veiled questions in the field of star formation. I present the result of the wide-field imaging survey of Chamaeleon molecular clouds in \lambda=1.1 mm continuum with AzTEC/ASTE. We obtained ~ 8 deg^2 map for Cha I and II molecular clouds and identified ~ 130 objects, including at least 5 Class 0/I protostar candidates, 11 T Tauri stars, and over 110 starless objects. The mean density of the starless objects is proportional to Mass$^{-0.5}$, which is consistent with the condition that the column density is constant. We constructed the core mass function (CMF) with our samples, which have almost the same shape as those of other star forming regions such as Perseus and Ophiuchus. In addition, the CMF well matches to the stellar IMF in this field. This consistency indicates that the CMF have a direct relation with the IMF.

SMA Observations of IRAM 04191+1522

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ASIAA

ABSTRACT
IRAM 04191+1522 is a very young, low mass protostar in Taurus, and is one of a small number of objects known as VeLLOs (Very Low Luminosity Objects). These objects are potentially protostars in the earliest stages of star formation. We will present SMA observations of the outflow and envelope of IRAM 04191+1522 in continuum emission and multiple lines of CO.

SMA Observations of Massive Protostar IRAS 20126+4104

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ABSTRACT

IRAS 20126 is perhaps the most promising massive protostellar candidate formed by mass accretion via a disk-outflow system. I will report the results of our high angular resolution study in both the line and continuum emissions toward this nearby massive protostar.

SMA Observations of the Prototypical Protostar B335

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ABSTRACT
B335 is a nearby (~ 250 pc) Bok Globule with a Class 0 embedded infrared source (IRAS 19347+0727; L_{bol} ~ 3 $L_{\odot}$) (Keene et al. 1983). The SMA observation of B335 in the ^{12}CO (J= 2-1), ^{13}CO (J= 2-1), $C^{18}O$ (J= 2-1), and 230 GHz continuum emissions was made as a part of the PROSAC project (Jørgensen et al. 2007). We have re-analyzed the data and found a compact ^{12}CO (J= 2-1) outflow component with a de-projected velocity of ~150 km s^{-1} in the vicinity (within ~ 1.5") of the central source. In addition, there are several HH objects aligned in the outflow axis, and the study of the proper motions shows the HH objects are moving away from the central source at the velocity of 200 ~ 280 km s^{-1} (Gålfalk & Olofsson 2007). However, no extremely high velocity outflow component has been reported before. The newly discovered outflow component is likely to be the counterpart of the EHV jets seen in the HH211 and HH212 outflows (Lee et al. 2006, 2007). The $C^{18}O$ (J= 2-1) map shows mixture of the inner envelope (2500 AU-scale) and outflow condensations, and there is no clear elongation. We found the signature of infalling motion in the $C^{18}O$ (J= 2-1) P-V diagram, but the structure is affected by the outflow component.

Dynamical Evolution and Thermal Structure of Molecular Clouds Illuminated by Strong UV Radiation Field

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ABSTRACT
We investigated the dynamical evolution of molecular clouds illuminated by strong UV radiation near H II regions. Our hydrodynamic simulations include not only UV radiation whose energy is higher than the Lyman limit (> 13.6 eV) but also far-ultraviolet (FUV) radiation (< 13.6eV) which has been ignored in most previous studies.

Our results show that FUV radiation heats dense layer compressed by ionization-induced shock through photoelectric heating. This high temperature makes Jean's mass larger than those of previous models, and helps formation of more massive stars.

SMA Observations of Complex Organic Molecules in the Orion KL Hot Molecular Core

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ABSTRACT
The Orion KL hot molecular core is known to be rich in organic molecules; the high luminosity (~10^5 $L_{\odot}$) and its proximity (~450 pc) makes Orion KL a primary target for interstellar molecular search and astrochemistry study. We will report our preliminary results obtained from SMA spectral observations of complex organic molecules CH_3CN, C_2H_3CN, C_2H_5CN, CH_3OH and $HCOOCH_3$ toward Orion KL. Molecular column densities and rotational excitation temperatures were attained from both the rotation diagram and the population diagram methods. Nontrivial line opacities and beam-filling factors have been found important in getting self-consistent solutions for many of the molecular transitions observed. Molecular fractional abundances derived were checked against existing chemical models for comparison. A marked chemical differentiation between the Hot Core and the Compact Ridge on a small spatial scale

is apparent at arcsecond resolution. Our SMA results hence provide new insights into organic chemistry in massive star-forming regions.

Evidence for Transient Clumps and Gas Chemical Evolution in Dense Cores of Molecular Clouds

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ABSTRACT
After several years of work, we have found strong evidence -- both observational and theoretical -- that molecular clouds are clumpy on a scale that is normally unresolved and that most of these clumps simply dissipate into an interclump medium on a timescale on the order of 1--2 Myr. We have studied the small-size structure of the cores found in the regions LDN 673 and HH 43 using different molecular transitions at moderate-angular resolution with the FCRAO telescope and combining them with interferometric high-angular resolution observations made with BIMA. We find that these cores are constituted by a heterogenous medium of condensations, of various densities and at various stages of chemical evolution.

The Magnetic Field Structure in the Massive Star Formation Site G5.89-0.39

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ABSTRACT
We present new observational results with high angular resolution (3") of the magnetic field structure around the Ultra-compact HII region G5.89-0.39. The goal is to analyze the role of the magnetic field in the massive star forming process.

The observations were carried out with the Submillimeter Array. Linear polarized emission from the dust grains at 870 micron was detected. Dust polarization is not uniformly distributed in the entire dust core. Most of the polarized flux is located around the HII ring, and there is no polarization detection in the southern half of the dust core except at the very southern edges. The detected polarized emission probably come from two different physical environments: 1.The position angles (P.-A.) of the polarization vectors in the east and west of the O5 star are smoothly distributed and consistent with the result from the NIR polarization observation. The axes of the molecular outflows at these locations detected in the CO 3-2 and SiO 8-7 emission lines are parallel to the B field lines. The dust core associated with these polarization vectors supports a bipolar outflow model. In this region, the magnetic field still plays a significant role in the star formation process. 2. The P.-A. of the polarization vectors in the NE and SW of O5 star vary by 40 degrees. The location of the polarization here is coincident with a compact ridge within the dust core. These polarization vectors could be tracing the shock front, where the B-field lines have been compressed by the shock/turbulence. The line-profiles of the $C^{17}O$ emission suggest that the shocked and swept-up material contributes 23% of the total mass of the dust core. This will require a substantial amount of kinetic energy to be able to sweep up such a huge mass. In this region the compressed B field lines parallel to the surface of the dense core would allow the outflow to progress along the field lines, but may impede its progress into the dense ridge.

Star-disk System in 3D Resistive MHD Simulations

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ABSTRACT
Numerical studies of protostellar outflows and their launching reveal mechanisms governing the physics of star-disk system. Present simulations continue our previous 2.5D investigations, now in full 3D setup and with largely improved ZEUS-MP2 code.

Study of Star Formation Regions Using CFHT/WIRCam

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ABSTRACT
Age, initial mass function and the rate of circumstellar disks are important parameters in the physical processes of star and planet formation. Our interesting is determining these parameters in young embedded clusters. Using WIRCam and IRAC, we are able to study the YSOs of interests. We present the observation results toward star formation regions, S233IR and Rho Oph. The age, IMF and disk rate of these clusters are presented. The age of S233IR is determined based on KLF. Higher star formation effeciency is observed toward the massive star formation region. The debris disk rates are also calculated based on their SED.

Zeeman Doppler Imaging of Magnetic Field on the Surface of Stars

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ABSTRACT
In this presentation I will review our current knowledge of the stellar magnetic field and its topology. The Zeeman Doppler method to image the magnetic field in rotating stars is then introduced. I will review the basic concepts and our implementation of the Zeeman Doppler method. Application of the method to derive the field topology on the surface of an O-type star and a M-type star is shown to emphasize the potentials and scope of the method.

Searching for Debris Disks around New Young Brown Dwarfs in the Solar Neighborhood

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ABSTRACT
We present our search for debris disks around new young bona-fide brown dwarfs with Lithium detected in the solar neighborhood (distance < 30 pc).

First Results from The Taiwanese-American Occultation Survey

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ABSTRACT
Results from the first two years of data from the Taiwanese-American Occultation Survey are presented. Stars have been monitored photometrically in the cadence of 4~Hz or 5~Hz to search for occultation events by small (~ 3km) Kuiper Belt Objects (KBOs). No significant events were found in nearly 111,000 lightcurve sets, containing about 2.3\times 10^9 photometric measurements. An upper limit to the size distribution of small KBOs could be determined by our substantial amount of two-year data.

A Search for Binary Kuiper Belt Objects in the CFEPS Samples

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ABSTRACT
Binary KBOs with a fraction of about 10% of the total KBO population are still an enigma. Their formation history and dynamical evolution are closely related to the early solar system accretion process and collision processes. A comprehensive census of KBO binaries is therefore an important goal in planetary research. We have initiated a project to search for KBO binaries in the distant moving objects data of the Canada -- France Ecliptic plane Surveys (CFEPS). A pipeline program has been developed to identify the binary object from the CFEPS data. We check 60 bright objects with good image quality and find a number of possible binaries. One of them is a strong candidate. For this result, the wide binary fraction of KBOs is about 1/60 and consistent with previous research.

On the Cause of Latitudinal Solar Differential Rotation and the Nonlinear Evolution of Solar Coronal Hole During the Raising Phase of the Solar Cycle

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ABSTRACT
The latitudinal solar differential rotation and the nonlinear evolution of the solar coronal hole are closely related to the solar cycle and the changes of the space weather and the space climate. A theoretical model is proposed to explain the cause of the latitudinal solar differential rotation in the solar convection zone and the nonlinear evolution of the solar coronal hole. A zero order equilibrium state is obtained based on the radial and latitudinal force balance among the pressure gradient force, the gravitational force, the Lorentz force, and the Coriolis force. Our results indicate that the latitudinal non-uniform Lorentz force due to presence of a dipole-like magnetic field in the solar convection zone during solar minimum can lead to poleward temperature gradient in the solar convection zone below $0.9R_{\odot}$. To balance the equatorward pressure gradient force, it requires a poleward Coriolis force, or an easterly wind (i.e., a westward zonal flow) in the mid-latitude solar convection zone. The long-lasting easterly wind in the solar convection zone can lead to the long-term latitudinal solar differential rotation observed in the solar convection zone. We also show that the easterly zonal flow is unstable to the latitudinal perturbation. A first order analysis shows that the wavelength of the unstable wave mode with lowest wave number is similar to the wavelength of the observed wavy filament structure observed in 02/22/1998, the wavelength of the periodic coronal loops observed in 07/05/1998, and the size of the initial coronal hole observed during raising phase of the solar cycles. We proposed that the nonlinear amplification of the latitudinal perturbation that can lead to nonlinear evolution of the solar coronal hole plays a more important role than the meso-scale turbulences during the raising phase of the solar cycle. The latitudinal temperature gradient and the change of rotation rate in the top layer of the solar convection zone ($1\sim0.9R_{\odot}$) and the top layer of the radiative zone ($0.6\sim0.7R_{\odot}$) will also be discussed.

In Situ Meteoritic Ti Isotopic Measurements by Laser Ablation MC-ICP-MS and the Homogeneity in Refractory Inclusions

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ABSTRACT
In situ laser-ablation multi-collecting inductively coupled plasma mass spectrometry (LA-MC-ICP-MS) has been successfully applied to the analysis of titanium isotopic ratios of several Allende Ca-Al rich inclusions (CAIs). Our purpose was to check whether the ^{50}Ti endemic effects are uniform within an individual CAI. We are capable of routinely achieve a spot size of 30\mu m with epsilon level precision

for a fassite mineral with ~ 3% TiO_2, comparable to the spatial resolution of secondary ionization mass spectrometry (SIMS) and the precision of thermal ionization mass spectrometry (TIMS). A normal type-B CAI and a FUN-like type-B CAI of Allende have been analyzed, and the results show that Ti isotopic compositions are homogeneously distributed within individual CAI, suggesting that either the reservoir that formed type-B CAIs was homogeneous in terms of the Ti isotopes, or the Ti isotopes were homogenized during the formation of type-B CAIs. Lastly, the observed mass dependent Ti isotopic fractionation in the Egg 3 CAI has enabled this technique to become a possible in situ alternative to quantify spatial variation of Ti isotopic fractionation effects within a given refractory phase.

High Energy Emission from Pulsars: Theory vs. Theory

Kouichi Hirotani
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ABSTRACT
We quantitatively investigate the particle accelerater (or a gap) in a pulsar magnetosphere, solving the set of Maxwell and Boltzmann equations. In the gap, electrons and positrons are accelerated by the magnetic-field-aligned electric field and radiate copious curvature photons. We demonstrate that the gap solution is obtained for arbitrary pulsars if we specify only the four parameters, period, period derivative, magnetic inclination, and magnetic moment, and that the solution quantifies previous, phenomenological outer-gap models.

We also apply the same scheme to an alternative model, slot-gap (SG) model, and show that the SG model does not work as a pulsar high-energy emission model. We present the results for the Crab pulsar and compare them with observations.

Identifying the X-Ray Sources in Low Core Density Globular Clusters NGC6144 & E3

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ABSTRACT
We report Chandra ACIS observations of two low core density globular clusters NGC 6144 and E3. The exposure time is approximately 55 ks for NGC6144 and 20ks for E3. We found 10 sources within the field of view of NGC6144 and 3 sources of E3. The luminosities of these sources are ranging from $L_x = 5.1 \times 10^{30}$ ergs/sec to 5.6×10^{32} ergs/sec in the 0.3 to 7 keV band (assuming they are the members of NGC 6144 and E3). We also compare our results with optical data for counterparts. From the X-ray spectral fitting and possible optical counterparts, we can determine whether these sources are within the globular clusters, or just background objects. Through studying the nature and the population of these X-ray sources, and by comparing these two clusters with each other, we can have a better understanding on cluster dynamics and formation in low core density globular clusters.

Probing the Nature of a Very Luminous Globular Cluster X-Ray Source in M31

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ABSTRACT
We present results of a very bright M31 globular cluster (GC) X-ray source Bo375 from our Chandra, XMM-Newton, and Suzaku observations. Bo375 is one of the most luminous GC X-ray sources in M31 (Andromeda Galaxy), and has a luminosity consistently above 10^{38} erg/s, which is much more luminous than typical GCs found in our Milky Way galaxy. There are several possible explanations for such a high luminosity: 1) the source might contain multiple components; 2) the source radiation might be beamed; 3) the source might be an accreting black hole, and 4) the source might be a neutron star in which the mass transfer proceeds on the thermal time scale of the donor star. To investigate why Bo375 has such a high luminosity, we study the light curves, X-ray spectra, and timing properties of the source from the data taken by Chandra, XMM-Newton, and Suzaku in detail. Previous observations showed that Bo375 has

short-term and long-term variability. The Chandra HRC-I data also shows that the source is consistent with a single point source. In this presentation, we will further show the new results from XMM-Newton and Suzaku, which might reveal the nature of Bo375, and of other luminous GCs in nearby galaxies.

Hydromagnetic Oscillations in the Crust of Paramagnetic Neutron Star and QPOs in Giant Flares of Soft Gamma Repeaters

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ABSTRACT
Working from the two-component, core-crust, model of paramagnetic neutron star the dipole magnetic moment of which is attributed to the permanently magnetized core, thought of as a spherical bar magnetic composed of neutron-dominated matter spin polarized to paramagnetic saturation by fossil magnetic field, we compute spectral equations for the frequencies of nodeless Alfven poloidal and toroidal axisymmetric oscillations trapped in the crust whose metal-like material is associated perfectly conducting electron-nuclear solid-state plasma permeated by uniform magnetic field frozen in the core. Based on the obtained equations, a modal analysis of quasi-periodic oscillations (QPOs) in flares of SGR 1806-20 and SGR 1900+14 is presented showing that observable frequencies of QPOs are properly described as manifest of toroidal Alfven mode of nodeless shear hydromagnetic oscillations.

Poster Exhibition/壁報論文展示

Dynamical Evolution of Solar Active Regions

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ABSTRACT
Coronal mass ejection events (CMEs) characterized by the eruption of magnetic clouds and plasma bubbles from the solar surface are closely related the study of space weather. In order to investigate the statistical correlation of CMEs, with the size and ages of active regions, we have performed a survey of the time evolution of a variety of active regions with the production of at least one CME. From the data, we will be able to estimate at what stage of the development of an active region a CME would occur.

A Study of the Rampart Cratersin Chryse Planitia

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ABSTRACT
Martian rampart craters are a special kind of impact craters which exist only on Mars. The formation of the plateau-like crater rims have been suggested to be caused by the mixing of the impact ejecta with water vapor buried underground. In addition, their shapes and morphologies can provide important information on the erosion and sedimentary processes during the time when the northern hemisphere of Mars was probably partly covered by water. In this work, 88 craters in Chryse Planitia and other 54 at latitudes between 65° and 80°N have been examined by using images and data from multiple instruments including the MOLA/MGS topographical measurements and the HRSC DTM measurements. A comparison of the depth-diameter relations of these two groups of rampart craters shows that there might be some regional differences in crater formation.

Neptune Migration Model withOne Additional Planet

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ABSTRACT
Traditional Neptune migration models (e.g., Hahn & Malhotra 2005) invoke four migrating Jovian planets in a swarm of planetesimals in the early stage of the solar system to explain the origin and the present spatial distribution of Kuiper Belt objects (KBOs). However, there are several weaknesses in Hahn & Malhotra's model results: (1) The ratios between resonant KBOs are inconsistent with observatoins. (2) High inclination KBOs in the classical belt and at Neptune's 3:2 resonance are too few. (3) The stirring mechanism to heat the initial particles is unclear. We try to improve that model by adding one extra planet with mass between Mars and Earth in the Neptune migration model. Simulation results under this picture are discussed in this paper.

Lulin Observations of Comet 17P/Holmes

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ABSTRACT
The coma of Periodic comet 17P/Holmes was observed to brighten up suddenly on October 24. Its total brightness increased from m= 17 to m= 2.8 within 42 hours, nearly half million folds than the brightness before the eruption. And 17P's coma was expanding rapidly in several days as the biggest object in solar system. Since the first report of this extraordinary cometary outburst, comprehensive observations were performed at the Lulin Observatory until mid November using wide-band BVRI and narrow-band cometary filters. In this work, we will report on the preliminary results from data analysis of this rich data set. In particular, we will show the temporal developments of the dust coma, the processed gas coma, and the ratio distribution of the dust density from the condensation center.

Millisecond Dip Events in the 2007 RXTE/PCA Data of Sco X-1 and the TNO Size Distribution

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ABSTRACT
Millisecond dips in the RXTE/PCA archival data of Sco X-1 taken from 1996 to 2002 were reported recently. Those dips were found to be most likely caused by instrumental dead time but may also contain some true astronomical events, which were interpreted as the occultation of X-rays from Sco X-1 by Trans-Neptunian Objects (TNO) of 100-m size. Here we report the results of search for millisecond dip events with the new RXTE/PCA data of Sco X-1 taken in year 2007. Adopting the same selection criteria as that in the previous study, we found only 3 dip events in 72-ks data, much fewer than the 107 events found in the 560-ks data taken from 1996 to 2002 reported earlier. The new data provides more detailed information of individual ‘very large events’ (VLEs), which is not available in the old archival data. Although the number of VLEs does not obviously increase during the occurrence of dip events, all the 3 dip events are coincident in time with VLEs that have no flags set for any of the propane or the 6 main xenon anodes. It is a strong indication of instrumental effects. No significant dips which might be real occultation by 60 - 100 m TNOs were observed. With only 72-ks data, however, the previously proposed possibility that about 10 percent of the dip events might not be instrumental still cannot be strictly excluded. Using the absence of those anomalous VLEs as the criterion for identifying non-instrumental dip events, we found, at a lower confidence level, 4 dip events of duration 8 - 10 ms in the 72-ks data. Upper limits to the size distribution of TNOs at the small size end are suggested.

Searching for Inner Oort Cloud Objectsin the TAOS Light Curves

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ABSTRACT
We present the result of searching for inner Oort Cloud objects in light curves from the Taiwanese-American Occultation Survey. The fact that we did not find any event has allowed us to put an upper limit on various models based on the power law index of size distribution and total number of Sedna-sized objects in the inner Oort Cloud.

A Study of the Diffraction Pattern by TNOs of Irregular Shape

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ABSTRACT
Serendipitous occultation is currently the only way to study the comet-size trans-Neptunian objects (TNOs). The occultation signal is basically restricted by the angular size of a target star and diffraction. One will be able to derive the size, shape, population, and even its distance through the study of TNOs' shadow on the ground. It was focused on the analysis of the diffraction pattern of spherical objects in most of the previous works. Though, a comet-size TNO is believed to be irregular in shape. Considering the spectral types of the background stars together with the spectral response of a CCD camera and a band-pass filter, we analyze the diffraction patterns by TNOs of various shapes. Using the boundary wave theory, we are able to study the statistical properties of these diffraction patterns. Our result should be helpful in the interpretation of the result of a TNO occultation surveys, such as the Taiwan-America Occultation Survey (TAOS) project. It can also be used in the related occultation simulation so that a more complete picture can be obtained.

Spatial Distribution and Seasonal Variations of Cryptic Region on Mars Using Multi-spacecraft Observational Data

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ABSTRACT
A distinctive feature named cryptic region on the south polar cap which is characterized by regions of low albedo and still lower temperature. In the cryptic region, many fan and spider shaped km-scale structures apparently caused by a wind-blown system of dust-laden gas jets occurred following the sublimation of the CO_2 frost layer. When season changes, the seasonal ice cap regresses and fans and spider appears alternately. These surface features are repeatable event that almost occupy the same area from year to year. In this study we use the MOC narrow angle images to analyze the surface features of cryptic region. Here we report the general physical environment of the cryptic region and have also counted the appearance of fans and spiders that go through a distinct seasonal evolution statistically. We propose that the fans features appear at the early spring and the spider-shape features appear at the late spring. We have also examined the relationship between the surface features and elevation changes which calculated by the surface topography observed by MOLA on MGS.

Dead or Alive: Observations of TwoComet-like Asteroids

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ABSTRACT
From the past investigation, 16% of near-Earth objects (NEOs) and 1% of main-belt asteroids (MBAs) has the active feature like a comet. That means there are almost thousands of active asteroids in our solar

system and could be defined as a comet. But only few hundreds of comets are discovered until now. In this work, we use the Lulin One-meter Telescope (LOT) to observed two asteroids with comet-like orbit (Halley Family Comets orbit), 2001 WU1 and 2005 WY3. The orbital element for 2001 WU1 is a= 3.14 AU, e= 0.57, i= 20.59; for 2005 WY3 is a= 6.74 AU, e= 0.74, i= 29.41. The absolute magnitudes (approximate of size) of those objects are also like a comet (few kilometers size). According to my observation, clear rotational light-curve was detected in both targets. A shape model can be build from the light-curve, but no coma or cometary active were be found.

Comets Swallowed by a Dying Star ? – Observations of H_2O and NH_3 in CW Leo

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ABSTRACT
Submillimeter lines of H_2O and NH_3 have been detected in the evolved star CW Leo (IRC +10216) with the Odin satellite. The estimated relative abundances of gas-phase water and ammonia are 2.4×10^{-6} and 1×10^{-6}, respectively. These abundances are much higher than prectictions from conventional gas phase chemical models. The detected H_2O and NH_3 may be a result of comets being swallowed in the expanding circumstellar envelope of the evolved star CW Leo.

Ultracool Dwarfs in the Galactic Plane: Discovery of Twenty L, Late-M Dwarfs in the Solar Neighbourhood

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ABSTRACT
We report on new nearby L and late-M dwarfs discovered in the Galactic plane over 4800 square degrees in the DEep Near Infrared Survey of the Southern Sky (DENIS) database.

Wide, Very Low Mass Binaries: A Test of the Ejection Models of Brown Dwarf Formation

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ABSTRACT
The ejection models for brown dwarf formation predict that the binary brown dwarf systems that do exist must be close (e.g., separation \leq 10 AU). However, the existence of wide very low mass binaries is at the first sight inconsistent with the ejection models or some of these apparent binaries could be unresolved higher order multiple systems, with a correspondingly higher total mass and binding energy. Our discovery of the triple system of very low mass stars LP 714-37 strongly supports this idea.

Circular Polarization Observations:Detection of Large-Scale Magnetic Fields inFully-Convective Low-Mass Stars

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ABSTRACT
Whereas it is widely accepted that the magnetic field topologies in partly convective stars (perhaps including early-M dwarfs) almost always involve a strong, large scale toroidal field component and differential rotation, the field topologies in fully-convective stars with masses below 0.3-0.4 solar mass are not clear so far because the current observations disagree with the models. As the number of observed stars are very limited, we have therefore observed circular polarization and mapped the field topology of a few partly and fully convective M dwarfs to provide strong observational constraints on the theoretical models.

Why Are There So Few Low-mass Hot Jupiters?

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ABSTRACT
It has been shown from the current observational data that there is a mass-semimajor axis correlation for hot Jupiters. This correlation is related to the absence of less massive giant planets within ~ 0.035AU from their parent stars. We employ numerical simulations to model the orbital evolution of a planet inside the magnetospheric cavity of a proto-planetary disk and compare the results with the observational data. Our numerical result shows that while a massive planet can cause effective stellar tides accompanied with a magnetic torque on its star and then undergoes an orbit decay, a less massive planet either survives or destructs at the 2:1 resonance with the inner edge of the disk depending on the eccentricity. We suggest that the tidal and magnetic interactions between young hot Jupiters and their parent proto-stars can explain the mass-semimajor axis correlation for hot Jupiters.

An On-site Coating Facility of Lulin 2m Telescope

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ABSTRACT
An on-site coating facility is an essential equipment to maintain good performance for the optical/infrared telescope. For the coating facility of 2m telescope, in addition to a evaporation coating chamber with the size fit for the primary mirror, it must equip with vacuum pumps to retain the pressure as low as 10^{-5} to 10^{-6} torr during re-coating, as well as a washing tower for stripping off the old coating from mirror and lifter or holder for moving the mirror, but the shipment of the mirror from Lulin observatory has large risk, then we propose to build an on-site coating facility suitable for 2m telescope to maintain its high-quality reflectivity for high-accuracy measurements. Once the machine set up at Lulin observatory, it does not only serve as a regular re-coating facility for 2m telescope but also provides coating operations for 1m telescope and other research equipments that require large coating facility in Taiwan.

The Construction Plan for a Rooftop Atomic Hydrogen 21-cm Telescope

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ABSTRACT
The Institute of Astronomy and Department of Physics in National Tsing Hua University have started to construct an educational radio telescope on the rooftop of the Physics building to study the kinematics of large-scale rotation in the Galaxy by observing the fine-structure transition of atomic hydrogen at 1420 MHz. We have completed the assembling of the reflectors and the Az-El mount as well as the beacon tests for the feed horn and the receiver frontend. We will continue to develop the receiver backend and the data sampling system.

Core-shielding Effect on Doubly Excited States of the Mg Atom in the MCRRPA

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ABSTRACT

The influence of relativistic and correlation effects on the cross section, angular distribution, and spin polarization parameters of photoelectrons is studied in detail. In the photon-energy region between the first and second ionization thresholds of autoionization due to the doubly-excited states, there are five Rydberg series coupling strongly to each other. The relation of the variations of the angular distribution, and spin polarization parameters in the vicinity of each resonance to the positions and widths of these doubly-excited states are studied.

Transition Energies and Oscillator Strengths in the Zinc I Isoelectronic Sequence of Astrophysical Interest

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ABSTRACT

Zinc I isoelectronic sequence play a very important role in many diverse research fields within astronomy and astrophysics. [1-4] From cosmology to stellar atmosphere dynamics, the transitions in these elements are likely to be observed in absorption in interstellar gas clouds, circumstellar shells, stellar winds, QSO winds, and clouds on the sight lines to QSOs. We have applied the relativistics many-body perturbation theory [5] to obtain the transition energies and oscillator strengths for the spin-allowed electric-dipole transitions in the Zn-like ions, GeIII, AsVI, KrVII, RbVIII, and MoXIII. All possible transitions among the first thirteen levels of these ions have been studied. The oscillator strengths obtained in different gauges are in excellent agreement. The present results agree well with experiment and other calculations. Near the neutral end data are obtained from extrapolation of our calculated results using the Z-expansion method. Ab initio calculations of the neutral Zinc are suggested and undertaken. Tabulation of transition energies and oscillator strengths from our calculations are presented for use.

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[5] H.-S. Chou, Phys. Rev. A 62, 042507 (2000)

Photoelectron Angular Distributions for Photoionization of the Be Atom

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ABSTRACT

Calculations of the cross section σ, angular distribution asymmetry parameter β, and photoelectron spin-polarization parameters {ξ,η,ζ} for double-excitation autoionization resonances of neutral beryllium using the multiconfiguration relativistic random-phase approximation (MCRRPA) are performed. Precise energies and widths of all five Rydberg series of doubly-excited states are given. Experimental studies on angular distribution of photoelectrons are suggested to obtain information on widths of some states, which cannot be obtain from total cross-section measurements.

Photoionization of the Be-like Boron Ion from the Ground State

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ABSTRACT
We have investigated photoionization of ground-state of the Be-like ion, Boron, in the photon energy range 25.16 to 31.15 eV. Calculations of the cross section \sigma for double-excitation autoionization resonances of the Be-like Boron ion using the multiconfiguration relativistic random-phase approximation (MCRRPA) are performed. Precise energies and widths of all five Rydberg series of doubly-excited states are given in the photon-energy region between first two ionization thresholds. In addition, calculations are compared with earlier theoretical and Experimental works and excellent agreement is also shown.

Near-Infrared Excess of Classical Be Stars

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ABSTRACT
Be stars are emission-line objects. A subclass, Herbig Ae/Be stars, are intermediate-mass pre-main sequence stars associated with appreciable amounts of surplus star-forming materials, giving rise to prominent infrared (IR) radiation in excess of stellar photospheric emission. On the other hand, classical Be stars, another subclass of the Be-star family on the verge of turning off the main sequence, also have IR excess. We computed free-free emission with classical Be star parameters and found that, as diagnosed in the JHK color-color diagram, almost all classical Be stars can attribute their IR excess to free-free emission. Those with exceptionally large IR excess (J-H, and H-K both greater than 0.6 mag) hence must be accounted for by circumstellar dust emission.

Near-Infrared Polarimetric Imaging of the Giant HII Region RCW57

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ABSTRACT
RCW57 (NGC 3576) is one of the brightest H II regions in the infrared harboring a group of massive stars with infrared excess indicative of their youth. We present the near-infrared JHKs polarization images, 7' on a side, taken by SIRPOL, an infrared polarimeter camera mounted on the 1.4 m Infrared Survey Facility telescope in Sutherland, South Africa. We present the polarization pattern of a few embedded young stars to delineate distributed circumstellar dust grains. The overall magnetic field of RCW 57, traced by polarization of background stars caused by Davis-Greenstein grain alignment, is found to roughly parallel to the extension of molecular clouds, lending support to magnetically dominated star formation (Girart et al. 2006). This is in contract to a free-fall cloud collapse which would have resulted in a random orientation of the cloud relative to the magnetic field (Crutcher 2006). Massive and low-mass young stars in the region are identified on the basis of their near-infrared colors. We discuss their spatial distribution in the context of the star formation history in RCW 57.

Young Stellar Population in the Lupus Molecular Clouds

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ABSTRACT
The Lupus molecular cloud complex is a nearby, yet relatively poorly studied star-forming region due to its southern sky position. Some of the molecular clouds in the region are associated with obvious ongoing star-forming activities (e.g., Lupus 1), while some without (e.g., Lupus 5). In a pilot study of the Lupus 3 cloud, which has the highest molecular column density and hosts the largest number of T Tauri stars – signifying recent, active star formation – we used archival UK Schmidt Telescope H-alpha images and the

2MASS point-source catalog to identify candidate classical T Tauri stars. A candidate H-alpha star is identified if it has a relatively stronger flux in the H-alpha image than the corresponding scaled flux in the SR (short red) image. Nearly all the previously recognized H-alpha stars were identified. Some of the bright candidates were spectroscopically confirmed to be H-alpha stars, but these could be just chromospherically active M dwarfs, rather than T Tauri stars. Yet others were found to show no H-alpha emission, but were selected because their continua are underestimated due to a series of prominent metal oxide, e.g., TiO, absorption lines, opically seen in a late-type star. We extended the analysis to all Lupus molecular clouds and present here our sample of H-alpha stars in the context of the star formation history in the region.

Modeling the Dust Polarization Emission from Molecular Cores

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ABSTRACT
Magnetic fields may play important even crucial roles in the processes of star formation. Unfortunately, measurements of magnetic fields from one particular method can only provide partial information of magnetic fields. For example, measuring the linear polarizations of the dust thermal emission, currently the most effective way to map the field geometry, can only give the field directions in the plane of sky. The observed dust polarization is an integral of the dust polarization along the line of sight which is a function of local field directions, density, temperature, and dust properties, etc. We construct a three-dimensional dust polarization model that incorporates the physical quantities affecting the observed values. By comparing the observed data and the polarization maps produced by our model, we attempt to constrain the physical conditions of the observed clouds.

Millimeter- and Submillimeter-Wave Observations of the Barnard 1-bN and Barnard 1-bS

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ABSTRACT
We have studied the physical and chemical properties of the two mm/sub-mm sources in the Barnard 1-b (B1-b) core. These two sources, B1-bN and B1-bS, show very cold (T_{dust} = 11–16 K) spectral energy distributions (SEDs), and have no mid-IR counterpart in Spitzer MIPS 24 and 70 micron bands. The chemical properties of these two sources are similar to those of pre-stellar cores. The $H^{13}CO^+$ J=1-0 emission is weak or barely detected toward the continuum peaks, while the N_2D^+ J=3-2 emission clearly traces the two compact sources. The lack of $H^{13}CO^+$ emission is probably due to the depletion of the $H^{13}CO^+$ molecule onto the grain under the condition of low temperature and high density, as in the case of pre-stellar cores. On the other hand, the CO 2-1 map observed with the SMA shows that B1-bS and probably B1-bN are associated with the compact (~ 2000 AU size) molecular outflows, suggesting that they are already harboring protostars. Observed physical and chemical properties suggest that B1-bN and B1-bS are in the very beginning stage of protostellar evolution, probably in the evolutionary stage between pre-stellar core and class 0 source.

Study of the Spatial Distribution of the Complex Organic Molecules in Orion KL

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ABSTRACT
Grain-surface chemistry and gas-phase reactions are both considered to be important to the formation of complex organic molecules (COMs) in high-mass ($M \geq 8\ M_{\odot}$) star-forming regions; however, the detail of the processes and mechanisms forming these COMs are still unclear and remain to be decided. High-resolution SMA (Submilimeter Array) observations of the Orion KL massive star-forming region at 1.3 mm were thus carried out and a number of COMs were detected. Among them, C_2H_5OH, NH_2CHO, and deuterated methanol CH_2DOH and CH_3OD were imaged in Orion KL the first time. Oxygen-bearing and nitrogen-bearing molecular species known to be abundant in Orion KL, e.g. $HCOOCH_3$, CH_3OCH_3, C_2H_3CN and C_2H_5CN, were also observed. Therefore, our SMA results not only will be useful but also crucial in distinguishing any possible differences in their spatial distributions of these COMs; such information is essential for testing the proposed formation paths and improving various existing chemical models.

Analyzing the Density Structure of Starless Cores and Star-Embedded Cores in the Spitzer c2d Database

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National Tsing Hua University

ABSTRACT
Measuring the density structure of starless cores and star-embedded cores is crucial for understanding the initial conditions and the evolution of star formation processes. We analyze several starless cores and cores with embedded MIPS sources in order to distinguish the difference between the density structure of these two types of cores. We found that in the cores with sufficient background stars, the starless cores in general have flattened density profiles at the inner part similar to the Bonnor-Ebert sphere, while the star-embedded cores are more consistent with power law density profiles. Such differences provide crucial constrains on the theories of the core evolution.

Preliminary Results from SMA Observations of the Low-Mass Class I Source IRS 46

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ABSTRACT
At a distance of 125 pc from the Earth, the low-mass Class I young protostellar object IRS 46 with an edge-on disk in the Ophiuchus cloud is known to have strong vibration-rotation bands of gaseous C_2H_2, HCN and CO_2. These IR absorption bands have been seen previously only toward deeply embedded high-mass YSOs associated with dense hot molecular cores. Because of the uniqueness of this Class I source, 230-GHz arcsecond-resolution observations of the important organic molecules H_2CO, and CH_3OH with the Submillimeter Array (SMA) were therefore carried out in April 2007. Our SMA observations of IRS46 are hence crucial for our understanding of the chemical evolution of solar-type protostellar disks similar to the Solar Nebular. Preliminary results from our SMA observations will be presented.

Photometric and Spectroscopic Identification of Binary Candidates in Planetary Nebulae

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ABSTRACT
Planetary nebulae play an important role in the evolution of low to intermediate mass stars ($0.8 \sim 8M_{\odot}$). A substantial amount of mass loss occurs when these stars evolve from the asymptotic giant branch (AGB) phase. Many PNe display distinct bipolar structures after the stage of proto-planetary nebulae. The

existence of binary systems (i.e., white dwarf plus a companion cool star) has been proposed to be one possible cause of the observed bipolarity. To clarify this important issue, we have initiated a spectroscopic survey of the nuclei of PNe using the BAO 2.16-m spectrograph. In the present report, we describe our first results showing that out of 12 PNe observed in our sample seven have absorption lines (CN λ4216, CaI 4226, G Band, Mg b, and TiO) characteristic of late type stars and another three have composite B/A or later then G type spectra. This suggests that a significant fraction (83%) of PNe must be of binary origin. The distributions of single white dwarf (WD) and WD + late type companions in the nuclei of PNe occupy distinct regions in the optical color-color diagram. In addition, 257 new binary candidates from archived data were identified by using selection criteria of V-R > 0 and B-I > -0.5. However, further observations are required to confirm these results.

Multiple Collimated Outflows in the Young Planetary Nebula NGC 7027

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ABSTRACT

The young planetary nebula NGC 7027 was observed in HCO^+(3-2) and HCN(3-2) with the SMA. The overall distribution of the HCO^+(3-2) emission is consistent with a thin, wall-like structure corresponding to the photodissociation layer imaged in the H2 line. In addition, the HCO^+(3-2) and HCN(3-2) emissions show two collimated bipolar flows. A third bipolar flow is identified in CO(2-1 and 3-2) observations with the SMA. These multiple outflows are carving the extended CO envelope of NGC 7027.

The K-Correction of the Type Ia SNe from the Carnegie Supernova Project

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ABSTRACT

Starting in 2006, the Carnegie Supernova Project has been making a comprehensive survey of nearby ($z < 0.07$) Type Ia SNe with a view to provide an independent estimate of the Dark Energy contribution to the total energy content of the Universe. To perform accurate distance measurements from the optical/ near-infrared light curves obtained by using a set of broad-band filters, K-correction must be applied to account for the modification of the brightness in certain filter bands as a result of the redshift effect. A progress report on the joint research work between NCU and Texas A&M is given here.

Two Early Gamma-ray Burst Optical Afterglow Detections with TAOS Telescopes ---GRB 071010B and GRB 071112C

Kuiyun Huang and TAOS team

ASIAA

ABSTRACT

Gamma-ray Bursts (GRBs) have been enigmatic phenomena for more than three decades since it discovery. In 1997, the first GRB (GRB970228) optical counterpart was observed, detection of transient optical emission associated with bursts become more important. Two broad classes are defined by optical emission during the first few minutes of a GRB. So far, only one case (GRB 050820A) showed temporal relationship of the two different components. High time-resolution observations in early phase are critical to reveal the two components and to study the GRB ejecta and the surrounding medium. The two cases reported here demonstrate the capability of the TAOS system to respond efficiently to a GRB alert. We

will describe the system response pipeline and in particular the scientific implication on early optical emission of GRB071010B.

Optical Observation of the Early Light Curves of Type Ib/c Supernova SN 2008D

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ABSTRACT
Some of the core-collapse type Ib/c supernovae (SNe) are found to be paired with long-duration GRBs. They are therefore of special interest in SNe physics. Of these objects, SN 2008D is of particular interest because its explosion was first detected in x-ray flash by SWIFT on Jan. 9th, 2008. Because of this early detection, ground-based observations were able to cover the light curve variation starting from the very first day. SN 2008D thus provides unique information on the dynamical behavior of the SN explosion at the very beginning. The one meter telescope (LOT) on Lulin was used to follow the brightness variations in mutil-wavelengths. We use this data set in combination with optical measurements from other observations to trace the initial interaction of the SN ejecta with the ISM.

Searching for Open Clusters in the Milky Way Disk

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ABSTRACT
We present the results of star counting of the 2MASS point sources to search for unknown open clusters. As the first attempt, we analyzed the zone along the Galactic disk, with longitude = 90 to 270 deg, latitude = -3.5 to +3.5 deg, and identified regions with stellar density enhancements not associated with previously known open clusters. Visual inspection of the DSS and 2MASS images led to a final list of 103 regions as likely star cluster candidates, for each of which the central coordinates, angular size, projected stellar density profile, and total number of cluster members were derived. A few dozen of these candidates have been observed with optical imaging to verify their cluster nature and if applicable to estimate their ages and distances. In comparison, there are about 500 open clusters presently known in the same region, about half of which with determined age/distance.

Survivability of a Star Cluster in a Dispersing Molecular Cloud

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ABSTRACT
Star clusters are formed in molecular clouds which are believed to be the birth places of most stars. From recent observational data, Lada & Lada 2003 estimated that only 4% to 7% of the clusters embedded inside molecular clouds have survived. An important mechanism for the disruption of embedded (bound)-clusters is the dispersion of the parent cloud by UV radiation, stellar winds and/or supernova explosions. In this work we study the effect of this mechanism by N-body simulations. We find that most embedded-clusters survive for more than 30 Myr even when different initial conditions of the cluster may introduce some minor variations, but the general result is rather robust.

Membership Identification in Star Clusters Using the UCAC Proper Motion Data

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ABSTRACT

Members in a star cluster share common location and motion in space, which in turn are manifest as grouping in the sky, the distance, and in proper motion and radial velocity, respectively. Here we present a pilot study to make use of the USNO CCD Astrograph Catalog (UCAC), a CCD sky survey for stellar astrometry, to distinguish probable member against field stars. In the direction to NGC 752, such a separation is obvious, and selection of probable members enables the determination of the cluster parameters (distance and age) with sufficient accuracy.

Molecular Superbubbles and Outflows from the Starburst NGC 2146

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ABSTRACT
We observed a nearby edge-on starburst galaxy NGC 2146 with the Nobeyama Millimeter Array (NMA) in the ^{12}CO(1-0) line. With the deep integration, we successfully detected weak, diffuse, and extended CO emission in NGC 2146 for the first time. Its kinematics indicates that there are two molecular bubbles and one kilo-parsec-scale molecular outflow outside the galactic disk. Comparison between our CO data and our Chandra X-ray observation suggests that expanding molecular bubbles/outflows are pushed outward by the energetic plasma from the galactic center.

Multi-wavelength Studies of Dust Reddened Quasars

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ABSTRACT
We present the multi-wavelength study of dust reddened quasars. It is believed that long wavelength radiation can penetrate interstellar dusts without being absorbed, thus radio and far infrared wavebands are widely used to study dust obscured objects. We select a sample of dust reddened quasars from the SDSS Quasar Catalog IV using 'relative color' – the color relative to their average color at specific redshifts – , and cross identify their FIRST, 2MASS, and ROSAT counterparts to investigate the multi-wavelength properties of the dust reddened quasars. Comparing the reddened quasars with normal ones, we have found several different properties between them. We also study their redshift dependency, which shows that the dust reddened quasars have different behavior at different redshifts. We conclude that the existence of dust in quasars do affect the emission properties and evolution of quasars.

Physical Properties of Molecular Clouds in Active Galaxies

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ABSTRACT
We study the physical properties of molecular clouds in active galaxies. Recent SMA observations have discovered several high temperature molecular clouds around the center regions of some active galaxies. The origin of the heating mechanism for these high temperature clouds is unclear. We analyze the thermal properties of these high temperature molecular clouds by considering various cooling and heating mechanisms within these clouds. We consider the cooling of several different atomic and molecular species, including C_I, C_{II}, H_2, and CO; and we consider the cosmic-ray and dust heating as two possible heating sources in our model. By considering the thermal balance between cooling and heating, we find that the cooling rates in these active galaxies are about three order or more higher than that in the Milky

Way. If the cooling is balanced by the heating of cosmic rays in the active galaxies, the ionization rates due to the cosmic rays can be as high as 10 to the power of -14 or -15. We conclude that such huge amount of cosmic rays must come from the central AGN.

Mass-to-Light Ratio of Galaxies In MOND

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ABSTRACT
MOND (MOdified Newtonian Dynamics) is an alternative to Dark Matter in explaining some dynamical properties of galaxy and cluster of galaxies, e.g., flat rotation curve of spiral galaxies. It also explains Tully-Fisher Relation of spiral galaxies and Faber-Jackson Relation (or fundamental plane) of elliptical galaxies. Combining velocity and luminosity data from SDSS, and 2MASS as well, we revisit the two relations in the context of MOND. We collect data for ~200 spirals and ~5000 ellipticals. From its velocity, we estimate the mass of a galaxy by MOND. We derive empirically the relation between the mass-to-light ratio of galaxies and observing wavebands. Moreover, we find that the longer the wavelength, the better is the agreement between theory and data.

Interferometric CO Image of the Nuclear Region of Seyfert 1 Galaxy NGC 1097

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ABSTRACT
We have mapped the central region of the Seyfert 1 galaxy NGC 1097 in ^{12}CO (J= 2-1) with the Submillieter Array (SMA). The ^{12}CO (J= 2-1) map shows a central concentration and a surrounding ring, which coincide respectively with the Seyfert nucleus and a starburst ring. The line intensity peaks at the nucleus, whereas in a previously published^{12}CO (J= 1-0) map the intensity peaks at the starburst ring. The molecular ring has an azimuthally averaged ^{12}CO (J= 2-1)/(J= 1-0) intensity ratio R21 of about unity, which is similar to those in nearby active star forming galaxies, suggesting that most of the molecular mass in the ring is involved in fueling the starburst. The molecular-gas-to-dynamical mass ratio in the starburst ring shows a somewhat lower value than that found in nearby star forming galaxies, suggesting that the high R21 of unity may be caused by additional effects, such as shocks induced by gas infall along the bar. The molecular gas can last for only about 1.2×10^8 years without further replenishment assuming a constant star formation rate and a perfect conversion of gas to stars. The velocity map shows that the central molecular gas is rotating with the molecular ring in the same direction, while its velocity gradient is much steeper than that of the ring. This velocity gradient of the central gas is similar to what is usually observed in some Seyfert 2 galaxies. To view the active nucleus directly in the optical, the central molecular gas structure can either be a low-inclined disk or torus but not too low to be less massive than the mass of the host galaxy itself, be a highly-inclined thin disk or clumpy and thick torus, or be an inner part of the galactic disk. The R21 value of ~1.9 of the central molecular gas component, which is significantly higher than the value found at the molecular gas ring, indicates that the activity of the Seyfert nucleus may have a significant influence on the conditions of the molecular gas in the central component.

Source Count Constraint on the Parent Population of SCUBA-selected Galaxies

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ABSTRACT
High redshift submillimetre galaxies (SMGs; z 2-3) observed by SCUBA at 850μm have spectral energy distributions (SEDs; 10μm - 1cm) similar to that of nearby Ultraluminous infrared galaxies. ULIRGs are one of the most powerful galaxy populations in the universe due to high star formation rate. Detailed

studies have shown that local ULIRGs are dust enshrouded and can be produced via strong interactions or mergers of gas rich galaxies; observations also show that about 98% of ULIRGs are merging systems. These suggest a high percentage of currently identified SMGs may also be in galaxy mergers. To investigate how the unresolved merger of SMGs can affect the shape of observed source count curve logN-logS (where N is the accumulated number of galaxies of flux greater than S), we simulate SMG source counts and compare the simulated results with the data obtained from SCUBA. A series of Monte Carlo simulations are carried out to generate mock catalogues of pre-merger SMGs with different initial source count slopes. The mock catalogues are further modified in accordance with the input percentage of merging pairs and the flux ratio distribution of pair members is also taken into account. Our simulation indicates that to account for the very steep source count curve of bright SCUBA sources, the merger fraction of 10-20 mJy SMG has to be above 90%. Based on our result, we make a comparison of the source counts between high redshift ULIRGs (SMGs) and local IRAS ULIRGs to discuss the nature of the parent population of SMGs.

Magnetic Fields and Turbulences in Clusters of Galaxies

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ABSTRACT
Magnetic fields and turbulences are among the most important non-thermal components in the intra-cluster medium (ICM), estimated to be 10% or more of the total thermal energy. We study the influence of large-scale magnetic fields by completing the hydrostatic equilibrium equation with the magnetic field pressure component. In a perturbative approach we derive a new gas density profile for the ICM which takes into account the magnetic field strength. The new gas density varies by up to 20% in the cluster core. Similarly, we parametrize the ICM turbulences assuming a uniform large-scale component generated by the cluster merger history and a radius dependent small-scale component from the motion of galaxies in the cluster core. We study the two contributions as a function of the model parameters and we point out their functional difference.

Galaxy Activity in Post-merger Clusters

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ABSTRACT
We combine a sample of about 1.3 k optically-selected clusters at redshifts $0.1<z<0.3$ from maxBCG catalog based on the 5th data release of the Sloan Digital Sky Survey (SDSS) and the FIRST radio survey data to investigate the relation between the intrinsic properties of galaxy clusters at intermediate redshift and their chronological merge stages. With the combined optical and radio data, we first identify the brightest cluster galaxies (BCGs) associated with double-lobe radio sources, followed by measuring the opening angle of each radio lobe pair as an indicator of the BCG velocity relative to the host cluster and merging stage. The opening-angles of cluster BCGs are subsequently compared with their redshifts, cluster richness, BCG luminosity, and cluster ellipticity. Furthermore, to study the environmental effect on cluster mergers, we also measure the inhomogeneity of mass distribution surrounding each cluster and the correlation between the moving direction of the BCG and the alignment position angle of the host cluster with its closest cluster. Finally the radio source fractions of selected cluster mergers and non-mergers are compared to explore the effect of the merging process on galaxy activity.

Constructing the Temperature Profiles of Clusters of Galaxies with Chandra

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ABSTRACT
Clusters of galaxies are the largest gravitational bound systems in the universe. Theoretically, clusters of galaxies consist of galaxies (seen in optical < 5%), hot gas/Intra-Cluster Medium (ICM, usually seen in X-ray ~ 15%) and dark matter (DM, could not been seen ~ 80%). Since DM is the dominate component within galaxy clusters, it is crucial to know how DM distributed in space in order to understand the

structure formation and evolution. However, DM can not be seen nor to be measured. The only hope is to infer the DM nature through measuring the properties of the observables. Temperature profile is an important probe to the mass properties in dynamically relaxed systems. By obtaining the temperature profile of a cluster and assuming hydrostatic equilibrium of the ICM, we can derive the density profile of the cluster and estimate the total mass. Once we know the baryonic mass distribution in space, we can therefore trace the DM distribution.

We selected a sample of galaxy clusters from the Chandra archive, with clusters which are symmetric, relaxed, and are not strongly interacting. With the high spatial resolution and excellent spectral ability of Chandra, we are able to measure the cluster X-ray surface brightness and radial temperature profiles in high precision. In this poster, we will present the initial analysis of X-ray clusters' spectral, radial, and temperature profiles. We will also discuss the basic properties of clusters which are relaxed and symmetric, and have less sub-structure within the clusters.

The ultimate goal for this project is to constrain the important cosmological parameters and compare with results with other methods such as weak/strong gravitational lensing, and Sunyaev-Zel'dovich effect.

Energy Dependent Pulse Arrival Time of the Accretion-powered Millisecond PulsarXTE J0929-314

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ABSTRACT
XTE J0929-314 is the third known accretion-powered millisecond pulsar, which is identified by Rossi X-Ray Timing Explorer in 2002 during its outburst (2002 April -- June). It is a faint, high Galactic latitude, transient, ultracompact X-ray binary. The purpose of this study is to investigate the energy dependent pulse arrival time of this source. Therefore, the fine pulse profiles, which require precise ephemeris to compensate the Doppler effect as well as other long-term phase drifts for the observed pulses, are essential. Unfortunately, for XTE J0929-314, no simple model can well-describe the pulse phase modulation in the whole 40 days' observations. We alternatively attempted to find the local best ephemeris and extracted pulse profiles in seven distinct energy bands between 2 and 14 keV for each observation ID (~ 1 to 2 hrs exposure). The energy dependent pulse arrival time differences were obtained through cross-correlating these pulse profiles. The weighted-average result for the observations shows that hard X-ray pulses arrived up to 810\mus (0.15 cycle) earlier than the soft ones from 2 to 8 keV and the lead saturates beyond 8 keV.

Quasi-Periodic Oscillation in SLX 1746-331

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ABSTRACT
We present our analysis results of Quasi-Periodic Oscillation (QPO) for the black hole binary SLX 1746-331 using the data collected by Rossi X-ray Timing Explorer (RXTE) during its outburst in 2003. A clear low frequency QPO with central frequency of $3.392^{+0.912}_{-0.187}$ Hz, was detected with no "band-limited" power continua. On the other hand, we found the significant QPO peak in the power spectrum of 2-35 keV band with central frequency located at $356.7^{+2.8}_{-3.2}$ Hz (90% confident range) in the early stage of its outburst when the X-ray flux was high. A few days later when the X-ray flux became lower, a $201.6^{+1.4}_{-1.2}$ Hz (90% confident range) QPO peak appeared in the power spectrum of 15-35 keV band. The frequency ratio of 1.7 is close to the ratio 1.5 seen other four black hole binaries. We conclude SLX 1746-331 is the fifth black hole binary exhibiting High Frequency QPO (HFQPO) in a 3:2 ratio.

The Gemiga Pulsar; Non-thermal Emission Mechanism and Emission Geometry

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ABSTRACT
The Geminga pulsar is one of the oldest gamma-ray emitting pulsars with a characteristic age t ~ 300000 yrs, but is one of the brightest gamma-ray pulsars. This pulsar will play an important role to discriminate the emission models, because the Gemiga is only one pulsar, which is radio quiet in the present, and because the next radio-quiet gamma-ray pulsar is expected to be detected in the unidentified EGRET GeV sources in the future. For the Gemiga pulsar, therefore, it is important to study the high-energy emission mechanism with the visibility of the radio beams.

We have reported the emission mechanism of the high-energy emissions from more younger pulsars, such like the Crab (t ~ 1000 yrs) and Vela (t ~ 10000 yrs) pulsars with the outer gap accelerator model. In this meeting, we report the results for the Gemiga pulsar. We calculate a model spectra by solving the dynamics in the high-energy emission region. The model spectrum is consistent with the observations in optical to gamma-ray bands. Using a geometrical model, we will discuss why the Gemiga is radio quiet.

The Long-term Variability of the X-ray Sources in the Central Region of M82

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ABSTRACT
We analyze data from Chandra observations of the starburst galaxy M82. By combining 10 Chandra observations taken between 1999 and 2007, we have identified 26 X-ray point sources within the central ~ 1.7' × 1.7' (1800 pc × 1800 pc) region of M82 down to a luminosity of ~ 5×10^{36} erg s^{-1}. 20 of the 26 sources exhibit long-term (i.e., days to years) flux variability. Within the total 26 sources, 20 are variables; 9 are transient candidates; only 2 are persistent sources (with constant flux), and 4 unclassified sources. By comparing with other galaxies, the high variability and luminosity of X-ray sources in M82 indicate that the source populations are dominated by accreting X-ray binaries. We will discuss the possible correlation between flux variability and star-formation rate.

Energy Dependent Pulse Arrival Time for the Accretion-powered Millisecond Pulsar SAX J1808.4-3658 in its 2002 Outburst

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ABSTRACT
We present the result of the phase shifts of the X-ray pulses in different energy ranges of the first known accretion-powered millisecond pulsar SAX J1808.4-3658 of its 2002 outburst observed by Rossi X-ray Timing Explorer (RXTE) Proportional Counter Array (PCA). To compare the pulse arrival times of different energy ranges, the fine orbital and spin parameters which reveal the correct pulse profiles are required. These parameters are refined through minimizing the variation of the pulse peak phases, which are yielded by folding the non-burst, 2-10 keV events with a model consisting of orbital Doppler Effect plus possible pulse phase drift described as a polynomial. We subsequently applied these parameters to fold the 11 energy bands of data allocated by event energy to obtain their fine pulse profiles. The phase delays relative to the softest band were derived through cross-correlating the corresponding pulse profiles. The results show a soft pulse lag in the first ~14 days' data up to 0.18ms and it saturates at > 9 keV, consistent with the one seen in its 1998 outburst. On the other hand, similar phenomenon is also seen in next ~ 26d data but the soft lag up to 0.375 ms, much more than the one we found in first 14 days, and also saturates at higher energy (> 13 keV).

X-ray Sources in the Galactic Globular Cluster NGC 6218 (M12)

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ABSTRACT
We study the Chandra X-ray Observatory ACIS-S observation of the Galactic globular cluster NGC 6218. With the 26 ks exposure time, we detect 5 x-ray sources inside the half-mass radius (2.16 arcmin) and one of them is inside the core radius (0.72 arcmin) of the cluster. If we assume these sources are all within the globular cluster NGC 6218, the luminosity Lx among these sources between 0.3-7.0 keV varies roughly from 10^{30} to 10^{32} ergs s^{-1}. In the near future, we will identify the optical counterparts and nature of these x-ray sources by analysing the Hubble Space Telescope data. Through this study and by comparing with other globular clusters, we can have a better understanding of the dynamical formation of x-ray sources in a globular cluster system.

Anomalous Orbital Period Change of the Low-Mass X-ray Binary EXO 0748-676

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ABSTRACT
EXO 0748-676 is an eclipsing low-mass X-ray binary (LMXB) system with a neutron star accreting matter from the Roche lobe-filling main-sequence star. This source exhibits a ~ 3.8 hr orbital period with a ~ 492 s eclipse durations. We analyzed the properties of the eclipses for EXO 0748-676 using the data collected by RXTE between 2001 and 2006. A two-hypobaric-tangent model was applied to model the eclipse profile to yield the parameters of eclipse, including mid eclipse time, the fiducial marker of binary orbital motion. The mid eclipse times were then analyzed with O-C method to reveal its orbital period variation. Combined with historical data, we found, however, no simple polynomial ephemeris may explain the variation of the residuals from O-C method. On the other hand, these residuals were better described as a sinusoidal function, or an abrupt orbital period change model, which probably is caused by existence of third star, or by the companion's gravitational quadruple moment change, respectively.

The Black Hole Mass in Seyfert 1 and Narrow Line Seyfert 1

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ABSTRACT
We investigate the black hole mass in Seyfert 1 and narrow-line Seyfert 1 galaxies using the bulge size-black hole mass relations in AGNs. Spectroscopic observations suggest that the black hole masses in Seyfert 1 and narrow-line Seyfert 1 galaxies might be very different. Previously, we found that the bulge size-black hole mass relation might be different in Seyfert 1 and narrow-line Seyfert 1 galaxies via analyzing a small sample of these galaxies. To obtain statistical significant results, we use the GALFIT package to analyze the bulge sizes of more HST images. We will discuss the new results and the implication on the origin of these two different types of AGNs.

Conserved Quantities of a Dynamical Black Hole

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ABSTRACT
On the consequence of nonlinearity of Einstein equations with asymptotically flat gravitational fields, the mass formulae are not conserved. However, we still can find some conserved quantities that the incoming rays combine with the outgoing rays on the null infinity to make the quantities conserved. These are so called Newman-Penrose constants that indicate the conserved quantities for the gravitating system with

gravitational radiation near null infinity. Similarly, we'd like to look at the space-time transformations that preserve the geometrical structure near black holes. Here we find the relevant asymptotic symmetry groups which allow gravitational radiation near the horizons. Further, we aim to find a new conservation law for the space-time inner boundaries that refer to a dynamical black hole horizon in non-asymptotically flat space-time.

Measurement of the Time Delay between Images of a Gravitationally Lensed System Based on Multiband Observational Data

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ABSTRACT
The intrinsic variability of the quasar appears in images of the gravitationally lensed system separated by time delays induced by the gravity field of the lensing galaxy and geometric path length difference between the two rays which form the images of the quasar. The time delays are easily determined from the cross-correlation analysis of the accurate and well-sampled light curves of the different quasar images. However, most often the time delay measurements are complicated by different sources of uncertainties such as the errors of photometry and errors due to observational sampling. By now a number of methods and strategies have been proposed to increase the accuracy of photometry. The presence of gaps in observational data is a more serious problem. The gaps, which sometimes dominate the data, can lead to misleading results in time delay measurements. In this work we show that the accurate multiband observational data can be used to improve the sampling of the light curves of quasar images. For the accretion disk with $T \sim R^{-3/4}$, the time delay between continuum flux variations is wavelength dependent as $\tau \sim \lambda^{4/3}$. This time delay is connected with the physics of the quasar and is the same for all images of the lensed system. The combination of the multiband data for each image of the quasar, taking into account the interband time delays between brightness variations in two different bands, can help to improve sampling and even to extend the visibility period of the lensed system.

Lulin Observations of the WEBT/GASP Campaigns

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中央大學 GASP 觀測小組

ABSTRACT
The Whole Earth Blazar Telescope collaboration enters its second decade this year (1997-). In addition to responding to outburst alerts, the Lulin SLT (40 cm) now is also part of the GLAST-AGILE Support Program (GASP) to provide long-term monitoring of a list of selected gamma-ray-loud blazars during the pointing of AGILE and GLAST space telescopes. Starting in March 2008, in a clear night, a handful to a dozen GASP targets are observed by the SLT queue for possible triggering of a global multifrequency campaign. The images are downloaded via internet the next morning to NCU for immediate processing by an undergraduate team. Here we present our organized contributions to the Program.

Necessity of Dark Matter in Modified Newtonian Dynamics within Galactic Scales? -- Testing the Covariant MOND in Elliptical Lenses

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ABSTRACT
Modified Newtonian Dynamics (MOND) and its relativistic version – TeVeS offer us an alternative prospect to understand the universe without the demand of the elusive cold dark matter. This MONDian paradigm is not only competitive with the conventional CDM in a large range of scales, but also even more successful than the CDM paradigm in the galactic scale. Recently Ferreras et al. (2008) claim that

MOND still needs dark matter even in galactic scales by studying 6 lensing systems. When we study the same systems, however, we yield an opposite conclusion. In this report, we present our results and conclude that MOND does not need dark matter in galactic lensing systems. We also extend our studies to 22 SLACS (Sloan Lens ACS Survey) lenses, we obtain the same conclusion in these systems as well.

Galactic Parameters from the Whole Sky 2MASS Star Count

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IANCU

ABSTRACT
The whole sky differential star counts with 1 degree radius resolution are queried from 2MASS data service. The data are fitted by a double exponential disk and a power law luminosity function (LF). The synthetic differential star count can be divided into 3 regions, bright, modest and faint, with slopes 0.6, 0.4(γ-1) and fast cutoff, respectively. The transition of bright and modest regions (the turning point), and that of modest and faint region (the turn-off point) can be determined by the scale length, H_r, the scale height, H_z, and the upper and low bound of LF, L_2 and L_1. However, since the bright star incompleteness, due to saturation, and the limiting magnitude, we cannot derive these parameters by this way. The modest magnitude region was used to derive the power law index of LF, γ, H_r and H_z, and the result is 1.8, 4.0kpc and 250pc respectively. With the best fit H_r, H_z, there is still some systematic discrepancy between the low and the high latitude area. The discrepancy cannot be explained away by a thick disk. Detail analysis shows that there is a dip on the LF around 0 absolute K_s magnitude. The dip is difficult to quantify but it seems to trace H_r and H_z.

Educational Oral Presentations/教育研討會報告

花蓮慈大附中天文教育推廣與花蓮縣自強國中天文教育概況

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ABSTRACT
自慈大附中搬遷至新校區後，校園最大的特色之一，便是設備新穎、功能齊全的天文館，天文館內的星象儀、望遠鏡可讓同學們清楚觀察太陽、行星、恆星及各種天體的多樣面貌。這座天文館，在教務處的規劃及台北天文館志工們的協助之下，運作也漸漸上了軌道，定期辦理天文教師研習、學生天文講座及各項天文活動，也在有特殊天象如月全食時開放民眾進入，使用望遠鏡觀測難得一見的景象。東部地區光害少，有天文館設備的慈大附中也希望天文教育不只在校園內實施，更可以在東部地區推廣天文，讓一般民眾、學生都能更了解天文、熱愛天文。

國中教育是培養學生基本、核心的能力，各項科目應力求簡化教材，去除本位主義，學生要學的東西已經太多；基本學測也不應力求題型新穎而跨越教材範圍，導致各版本教材陷入深入教材的迷思；若以現行九年一貫統整教育，地科教學時數每週一節，教材、考題都應簡化，讓老師有充裕時間陪學生做太陽、星星及月亮的觀測，認識四季星座，看看「阿波羅 13 號」、「2006 明天過後」及「不肯面對的眞相」等影集，也許學習的快樂一些，也學的更多。

後山兒童的天文想像與探究經驗之對話

Indigenous children's astronomic ideas and inquiry experience in a cultural-responsive, inquiry-based astronomical teaching program

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ABSTRACT

本研究探究原住民兒童的天文相關概念，了解文化傳說、族群智慧、與日常經驗與原住民兒童天文相關概念發展之關係，並導入文化回應式的天文探究教學歷程，以提昇原住民兒童對天文科學領域方面的探究興趣與科學探究能力。本研究採用訪談與準實驗法進行，研究對象以布農族和阿美族爲主，包括幼稚園至國小六年級兒童，第一年 184 名接受天文概念訪談，第二年和第三年分別爲 85 名和 64 名各參與九週的天文探究教學課程。資料來源包括兒童學習歷程檔案和訪談評量，同時以質的和量的方式進行資料分析。

第一年研究結果發現原住民兒童並不因其居住大自然環境易觀察天空現象，而有更多關於天空中事物的觀察和知識，即使接受過正式課程的五年級，還是有相當多迷思，顯示現有教學對其建立天文相關概念幫助不大。多數原住民兒童並未聽聞過原住民天文傳說，也極少能用本族語說出天空中東西，顯現族群天文智慧乏人關懷和未被傳承的危機。

第二、三年的研究結果顯示文化回應式天文探究課程可以提升各年齡層原住民的科學學習興趣、思考和探究能力。然而，天文概念的發展有如音樂的徐緩調，是緩慢漸進的過程，兒童對於複雜的天文現象的理解、建立科學性解釋、並了解其與傳說神話之差別，仍是需要一段時間；兒童天文概念不受其年齡和先前課堂學習經驗而影響，而符合原住民文化特性的天文探究教學過程有助兒童的理解與概念之建構。

關鍵詞：天文概念、原住民兒童、科學教育

The purpose of this study is to explore the relationship between cultural heritage and the development of astronomic scientific concepts of indigenous children. Children from kindergarten to grade six, in total 184, were interviewed in the Year I. There were 85 participants in the Year II, and 65 participants for Year III intervention groups. A quai-experimental design and multiple data collection methods were employed. Children's learning portfolios were collected through the teaching process and individual interviews were conducted after the 9-weeks program. A qualitative data analysis and a comparative analysis are employed. The paper will present indigenous children's imagination and ideas of the astronomical phenomena, and the effects of the cultural-responsive, inquiry-based astronomic program. The finding shows that the inquiry-based astronomic program is success in bringing up indigenous children's learning interests in science and their scientific reasoning and inquiry abilities. However, the development of astronomic concepts is like an andante. It takes time for the children to establish a fully understanding of the complicated astronomical phenomena. It also requires reciprocal dialogues to help children construct scientific explanations which different from the folktales. However, age and prior classroom learning experience do not make differences in terms of their understanding of the astronomical phenomena. As a result of this study, a cultural-responsive, inquiry-based astronomical teaching model for indigenous science education is suggested.

Key words: astronomic concepts, indigenous children, science education

教案表達的精準性 ── 月相盈虧互動教具

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ABSTRACT

國中自然科教師的主要工作有點像是「導遊」。我要求自己在每一堂課後寫筆記，記下學生的反應、修改教案的順序、製作恰當的教具、找尋最精準的表達方法。我想讓學生能在最少的時間內「知道我在說什麼？我在建構的方向！」。

教室講桌上擺一尊「維那斯」雕像，讓三十位學生從三十個角度去素描，結果每個人都會畫出不同的維那斯。同樣的道理。自然現象的教學，必須很小心的處理這種「三十個角度」的問題，才不會造成學生的入門瓶頸。

月相盈虧，就是一個很容易讓師生感到挫折的課程。舉凡三維空間觀念（三十個角度的問題）、月球自轉與公轉等速的概念、相對方向、時間的定義、日期的辨認、遠距物體移動的視角問題，每一個概念的建構都需要教師專業的引導。

直到完成「月相盈虧」互動動畫，我在動畫中統一讓學生從北極上空來思考問題，並且將「地表爲中心、太陽爲中心」的兩個模型同時並存於螢幕上。如此一來，利用「比對」畫面很容易就克服了大部分學生的學習瓶頸，並且精確的傳達出教案的目標。

話說「河瀚」

曾麗英 老師
臺北縣三重國中

ABSTRACT

河瀚天文讀書會是由松山高中的翁雪琴老師所發起，主要由一群喜歡天文的台北縣市國、高中教師所組成。當時，成員們大多數已經從學校畢業一段時間，面對學校的教學和各項天文新發現，深深感到所學不足，但平日獨學而無友，經過考慮之後，覺得以讀書會的形式可能最符合大家的需求。在與國立台灣師範大學傅學海教授討論後，獲得其肯定並答應長期提供指導，因而召集有興趣的夥伴於 1996 年 9 月成立河瀚讀書會。由於大多數是師大地科系的系友，在傅教授的協助之下，我們以地科系爲活動地點，並決定密集性地於學期中每週一晚上聚會。

河翰成立之初，成員們以擴展所學爲主，閱讀有關天文方面的書籍、雜誌，以及網站上的相關文章，以吸收新的資訊，也曾敦請專家學者作專題演講。後來，覺得國內天文風氣有待更進一步推廣，同時也能將所學作一整理發表，因而開始向外活動。河瀚曾支援台北縣市高中天文研習營、高雄縣市高中天文研習營、台北市天文協會和中華少年成長基金會舉辦的活動等等，部分成員還擔任台北市天文協會每月天文推廣活動的講師，以及國內第一份天文月刊《觀星人》的編輯工作，我們的第一本天文科普書籍《星星的故事》於 2000 年出版，並於寒暑假舉辦天文營隊，北一女中的周家祥老師還爲河瀚成立網站。

不過，由於河瀚的聚會非常密集，而成員白天要忙自己的工作，晚上要照顧家庭，再抽出時間參與讀書會，實在是件不容易的事情。再加之，並未向外廣做宣傳，招募新成員。因而，成員逐漸減少，目前呈休會狀態。但我們仍在等待風起的時候，揚帆出發。

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