Astronomical Society of New York Fall Meeting
October 25, 2003
Emerson Auditorium, Skidmore College

Prize lectures are 30 minutes plus 5 minutes for discussion, invited talks are 40 plus 5, and contributed talks are 12 plus 3.

Morning Session

9:00 Coffee and Pastries

9:45 Invited Talk
Aliens: The Scientific Search for Life on Other Planets
Ben R. Oppenheimer (American Museum of Natural History)

10:30 Contributed Talks I
Photoionization Feedback in Low-Mass Galaxies at High Redshift
Mark Dijkstra (Columbia U.)

XMM Observation of Rich Clusters
Dave Spiegel (Columbia U.)

Radio and Millimeter observations of z~2 QSOs
Andreea Petric (Columbia U.) & C. Carilli (NRAO)

Analyzing Current and Future Deep Field Surveys
Stefan Gromoll & Kenneth M. Lanzetta (SBU)

11:30 ASNY Graduate Student Prize Lecture
Refining Chandra/ACIS Subpixel Event Repositioning Using a Backside Illuminated CCD Model
Jingquang Li, Joel Kastner (RIT), Gregory Y. Prigozhin, Norbert S. Schulz (MIT)

Lunch
(courtesy ASNY and Skidmore)
12:15 Faculty-Staff Club, Case Center

Afternoon Session

1:30 Special Presentation
Falling Bodies: The first of a new Educational Physics video series
Jill Linz (Skidmore College)

2:00 Invited Talk
Jets from Young Stars
Hsien Shang (Institute of Astronomy and Astrophysics, Academia Sinica, Taiwan (ASIAA))

2:45 Contributed Talks II
Dynamical Masses of Young Stars in the Taurus Star Forming Region
Gail Schaefer, M. Simon (SBU), E. Nelan, S.T. Holfeltz (STScI)

Mid-Infrared Imaging of Young Stellar Objects
Ben Sargent (U. Rochester)

3:15 Coffee Break

3:30 Contributed Talks III
GGD 12-15: Investigating Clustered Star Formation
R.A. Gutermuth (U Rochester), S.T. Megeath (Harvard-Smithsonian CfA), J.L. Pipher (U. Rochester), L.E. Allen, P.C. Myers (Harvard-Smithsonian CfA)

A Survey of the Irregular Satellites
P.D. Nicolson, M. Cuk, V. Carruba & J.A. Burns (Cornell), R.A. Jacobson (JPL)

Measuring Seeing with Microthermal Sensors
Masaki Tsukuda, Kenneth M. Lanzetta (SBU) and Paul Hickson (UBC)

Finding and Following Type Ia Supernovae with the Large Zenith Telescope
Benjamin Johnson (Columbia U.)

4:30 End of Meeting

Abstracts

9:45 Invited Talk

Aliens: The Scientific Search for Life on Other Planets

Dr. Ben R. Oppenheimer (American Museum of Natural History)

The discovery of life outside the solar system could arguably be one of the most important discoveries ever made. In fact, Astronomy and Biology are on the verge of a fascinating new convergence. Astrobiology, a new research initiative in several countries around the world, seeks to identify habitable planets outside our own solar system, and to identify the presence of life on such planets. However, to do this is extremely difficult, and chances are we won't be seeing little green men for quite a long time, even if they are out there. This lecture will attempt to explain the reality of the search for life in the universe, including a description of the techniques, what astrobiologists currently expect to find, and how all this might happen within a matter of two decades.

10:30 Contributed Talks I

Photoionization Feedback in Low-Mass Galaxies at High Redshift

Mark Dijkstra (Columbia U.)

The cosmic ultraviolet (UV) ionizing background impacts the formation of dwarf galaxies in the low--redshift universe z ~ 3 by suppressing gas infall into galactic halos with circular velocities up to v_circ ~ 75 km/s. Using a one--dimensional, spherically symmetric hydrodynamics code (Thoul \& Weinberg 1995), we examine the effect of an ionizing background on low--mass galaxies forming at high redshifts (z>10). We find that the importance of photoionization feedback is greatly reduced, because (1) at high redshift, dwarf--galaxy sized objects can self--shield against the ionizing background, (2) collisional cooling processes at high redshift are more efficient, (3) the amplitude of the ionizing background at high redshift is lower, and (4) the ionizing radiation turns on when the perturbation that will become the dwarf galaxy has already grown to a substantial overdensity. We find that because of these reasons, gas can collect inside halos with circular velocities as low as v_circ ~ 10 km/s at z>10. This result has important implications for the reionization history of the universe.

XMM Observation of Rich Clusters

Dave Spiegel (Columbia U.)

Rich clusters of galaxies can be clearly identified in x-ray images from Chandra and XMM-Newton, consistent with their containing a large fraction of their baryonic mass as hot, highly ionized, diffuse gas. Some small groups of galaxies in the local universe have also been seen to contain a hot-gas component. Preliminary results from a 50 ksec XMM observation of a field with approximately 30 optically-identified galaxy-groups between redshift 0.1 and 0.6, however, indicate no spatial or spectral correlation between groups and x-ray emission. I will discuss the results and their possible importance.

Radio and Millimeter observations of z~2 QSOs

Andreea Petric (Columbia U.) & C. Carilli (NRAO)

We present Very Large Array observations at 1.4 and 5 GHz of a sample of 16 quasi-stellar objects (QSOs) at z=1.78-2.71. These sources were chosen to have similar optical properties

(M_B, spectra) as samples of ($z \geq 3.7$ QSOs) for which we have comparable (sub)millimeter (250 GHz) and centimeter observations. Half of the chosen quasars are bright at 250 or 350 GHz while the other half have not been detected at either of these frequencies. All eight FIR rich sources in our study were also detected at 1.4 GHz but only 3 of the FIR poor QSOs were barely detected at radio frequencies. This suggests a real physical difference between the FIR-luminous and FIR-quiet sources. If the super-massive black holes fueling these QSOs are accreting at Eddington rates and if the FIR is associated with star formation then we estimate that the spheroid and central-black hole grow on similar time-scales supporting the recent picture of their co-evolution.

Analyzing Current and Future Deep Field Surveys
Stefan Gromoll & Kenneth M. Lanzetta (SBU)

In 1995 the Hubble Deep Field provided the deepest image of the universe ever observed. The recent Great Observatories Origins Deep Survey (GOODS), while not as deep, covers 32 times the combined solid angle of the HDF and CDFS HST fields. The GOODS dataset is much more complex than the HDF data, consisting of 15--16 individual pointings covering the entire 10'x16' region, taken in 4 bandpasses (not including associated ground--based and SIRTF data). In addition, the data have been taken in five epochs, each seperated by 45 days, with the field of view rotated approximately 45 degrees between epochs. This amounts to a vast amount of fairly complex high quality deep imaging data which is available for analysis. The upcoming HST Ultra Deep Field survey (UDF), promises to be just as complex, and will extend around 1--2 magnitudes deeper than the HDF. Hence we identify two primary challenges with current and near future deep field surveys: to process such computationally large and complicated datasets, and to process them optimally to extract as much information as possible from these expensive and content--rich data. I will present our group's efforts to push the limits of photometric redshift and galaxy spectral type determination in these large datasets.

11:30 ASNY Graduate Student Prize Lecture
Refining Chandra/ACIS Subpixel Event Repositioning Using a Backside Illuminated CCD Model
Jingquang Li, Joel Kastner (RIT), Gregory Y. Prigozhin, Norbert S. Schulz (MIT)

Subpixel event repositioning (SER) techniques have been demonstrated to significantly improve the already unprecedented spatial resolution of Chandra X-ray imaging with the Advanced CCD Imaging Spectrometer (ACIS). Chandra CCD SER techniques are based on the premise that the impact position of events can be refined, based on the distribution of charge among affected CCD pixels. ACIS SER models proposed thus far are restricted to corner split (3 and 4 pixel) events and assume that such events take place at the split-pixel corners. To improve the event-counting statistics, we modified the ACIS SER algorithms to include 2 pixel split events and single-pixel events, using refined estimates for photon impact locations. Furthermore, simulations that make use of a high-fidelity backside-illuminated (BI) CCD model demonstrate that mean photon impact positions for split events are energy dependent, leading to further modification of subpixel event locations according to event type and energy, for BI ACIS devices. Testing on Chandra CCD X-ray observations of the Orion Nebula Cluster indicates that these modified SER algorithms further improve the spatial resolution of Chandra/ACIS, to the extent that the spreading in the spatial distribution of photons is dominated by the high-resolution mirror assembly, rather than by ACIS pixelization.

1: 30 Falling Bodies: The first of a new educational Physics video series
Jill Linz (Skidmore College), co-written by Matt Christie (Skidmore '02) and Kendrah Murphy (Skidmore '03)

Falling Bodies was written and produced in an effort to introduce physics into elementary schools. It is a comedic look at the historical development of our knowledge of how objects fall. Initially, members of the Skidmore Society of Physics Students traveled to a local school and performed this skit live to each sixth grade class. The sixth graders then recreated Galileo's famous experiment on falling bodies using a water clock. While this program enjoyed great success, it was logistically complicated to perform on a regular basis. Therefore, we produced this movie version. In addition to the 20-minute movie shown today, there is an additional instructional video that explains to teachers how to perform the experiment in their classes. We hope this will aid teachers in introducing physics into their classes.

2:00 Invited Talk
Jets from Young Stars
Hsien Shang (Institute of Astronomy and Astrophysics, Academia Sinica, Taiwan (ASIAA))

Recent observations have revealed that young stellar objects are associated with jet-like structures and Herbig-Haro objects emitting at wavelengths ranging from the optical to radio. These phenomena are similar in scale and morphology, and have mostly comparable energetics, dynamics, and kinematics. Probing such phenomena observed at various wavelengths with self-consistent models of the physical and radiative processes arising within an inner disk wind, driven magnetocentrifugally from the circumstellar accretion disk, is a challenge for confronting theory and observation. I will discuss our efforts at modeling these jet phenomnea, and the diagnostic approach for comparing observations from optical to radio wavelengths.

2:45 Contributed Talks II
Dynamical Masses of Young Stars in the Taurus Star Forming Region
Gail Schaefer, M. Simon (SBU), E. Nelan, S.T. Holfeltz (STScI)

We have been monitoring the orbital motion in the young binaries DF Tau and ZZ Tau and the hierarchical triple Elias 12 using the Fine Guidance Sensors on the Hubble Space Telescope and adaptive optics at the Keck Observatory (Schaefer et al. 2003, AJ, in press, astro-ph/0307020). Preliminary calculations show that the orbital parameters for these systems cannot yet be determined precisely because the orbital coverage spans only about 90 degrees in position angle. Nonetheless, the distribution of possible values for the period and semimajor axis already defines a useful estimate for the total mass in DF Tau and ZZ Tau, with values of 0.90 (+0.85/-0.35) Msun and 0.81 (+0.44/-0.25) Msun, respectively, at a fiducial distance of 140 pc.

Mid-Infrared Imaging of Young Stellar Objects
Ben Sargent (U. Rochester)

With the launch of the Space Infrared Telescope Facility (SIRTF) comes the possibility of obtaining reliable infrared spectra, using SIRTF's Infrared Spectrograph (IRS), of sources which are relatively faint at infrared wavelengths. In anticipation of the success of the IRS, an observation/spectrography program, IRS_Disks, has been prepared, in which images and spectra of numerous Young Stellar Object (YSO) candidates will be obtained. YSO's are so named because they are believed to be stars that have formed within only the last few million years, and, thus, are most likely still enshrouded or orbited by the remnants of the dust and gas from which they collapsed and formed. One of the major goals of the IRS_Disks program, then, is to understand better the formation and evolution of these YSO's. In preparation for the IRS_Disks program, data obtained from ground-based observatories is necessary, in order to interpret the data expected to be received from SIRTF.

To this end, ancillary ground-based data have been obtained for IRS_Disks YSO candidate objects. Since stars are expected to form as members of clusters, and YSO's are frequently observed to be members of such multiple-star systems, astrometry is critical in interpreting the photometry of these candidate YSO's. Photometric and astrometric results using MIRLIN (11.7 micron) and NSFCam (2.2 and 4.7 micron) on the IRTF for a few of these objects in the rho Oph cloud will be presented and discussed. Since obtaining reliable photometry and astrometry of faint sources from data taken at infrared wavelengths is difficult, the photometry and astrometry techniques used in analyzing the data will be discussed as well.

3:30 Contributed Talks III

GGD 12-15: Investigating Clustered Star Formation

R.A. Gutermuth (U Rochester), S.T. Megeath (Harvard-Smithsonian CfA), J.L. Pipher (U. Rochester), L.E. Allen, P.C. Myers (Harvard-Smithsonian CfA)

The GGD 12-15 region exhibits several signs of ongoing, active star formation, including multiple Herbig-Haro objects, a moderate velocity bipolar molecular outflow centered on a water maser (Little, Heaton, & Dent 1990), and a compact H II region detected in radio continuum (Gomez, Rodriguez, and Garay 2000). Carpenter (2000) detected a significant extended cluster of objects in the near infrared using the 2MASS Point Source Catalog. To investigate this object further, we obtained wide-field (10' x 10') J, H, and K band images of the GGD 12-15 region with the FLAMINGOS instrument on the 6.5 meter MMT Telescope. Given a distance of 830 pc to GGD 12-15, we are capable of detecting 1 Myr old, 25 Jupiter mass sub-stellar objects attenuated by 10 magnitudes of visual extinction. We measured the peak stellar density and compared the stellar density distribution morphology to CO maps of the molecular gas distribution and 850 micron maps of dust emission. As part of a SIRTF Guaranteed Time Observation program, these data will be combined with SIRTF images of the region to determine the complete 1-24 micron SED for each star in the region. The combined ground-based/SIRTF observations will provide unparalleled insight into the incidence and properties of protostellar envelopes and protoplanetary disks in this region.

A Survey of the Irregular Satellites

P.D. Nicolson, M. Cuk, V. Carruba & J.A. Burns (Cornell), R.A. Jacobson (JPL)

The last six years have seen an explosion in the number of known natural satellites in the Solar System. From a total of 61 moons listed in 1997, the inventory has now climbed to 134, including seven announced in just the last month. The vast majority of these newly discovered objects are distant satellites of the jovian planets, which move on highly eccentric and inclined orbits. At the latest count, Jupiter has 61 moons, followed by Saturn (31), Uranus (26) and Neptune (13). Already interesting patterns have begun to emerge among the orbital elements of these so-called "irregular" satellites. The jovians fall into at least four more-or-less distinct groups, each centered on one or more larger bodies, with the great majority on retrograde orbits. The smallest objects have diameters of order 2 km. The saturnians form two very tight prograde groups plus a third more diffuse retrograde group probably related to 220 km diameter Phoebe. All seven uranians are retrograde, but are only poorly clumped. The most distant has an orbital period of over 7 years, while two have eccentricities exceeding 0.5. The six known neptunians are evenly divided between prograde and retrograde orbits, with periods ranging from 1 to 24 years; all but one have eccentricities which exceed 0.4. In addition to summarizing their orbital characteristics I will briefly review theories proposed for their origins and discuss several interesting dynamical characteristics identified in recent work at Cornell. This work is supported by NASA's Planetary Astronomy and Planetary Geophysics programs.

Measuring Seeing with Microthermal Sensors

Masaki Tsukuda, Kenneth M. Lanzetta (SBU) and Paul Hickson (UBC)

Atmospheric turbulence associated with an inhomogeneous index of refraction in Earth's atmosphere reduces astronomical seeing. Fluctuations of the index of refraction are caused by very small thermal fluctuations in the atmosphere. Because the atmospheric environment largely affects the performance of astronomical observation with optical telescopes, it is important to carefully choose the sites of new telescopes. In order to quantify the atmospheric turbulence, a set of microthermal sensors can be used to monitor and record small thermal fluctuations in the atmosphere. These sensors take advantage of a property of the Wheatstone bridge to measure temperature differences between two fixed points. I will present the current status of the microthermal sensors that my group has been developing to measure such temperature differences, including their design, expected performance, and assembly.

Finding and Following Type Ia Supernovae with the Large Zenith Telescope

Benjamin Johnson (Columbia U.)

Abstract: Type Ia supernovae (SNe) have become an important tool in observational cosmology, leading to many projects dedicated to their discovery and characterization. Large photometric surveys conducted with the aim of identifying many Type Ia SNe at moderate redshift face a problem when attempting to separate these SNe from other SN types. Spectroscopic determination of the SN types, the traditional method, requires lots of time on large telescopes. I therefore examine the possibility of using only broadband colors, magnitudes, and their evolution to constrain the SN type. This is done in the context of upcoming observations by the Large Zenith Telescope (LZT). The LZT (a collaborastion between UBC, Columbia,SUNY/Stony Brook, and AMNH) is a zenith pointing telescope with a 6-meter diameter liquid mercury primary mirror. It will be able to detect Type Ia SNe to redshifts less than about 0.8. These SNe can be used to determine the expansion history of the universe, as indicators of star-formation, and to learn about their progenitors.