NC Astronomers' Meeting Saturday, 1 October 2005
Auditorium, Sears Applied Technologies Center,
Guilford Technical Community College, Jamestown, NC

Meeting space opens at 9:00 a.m.
Refreshments are available throughout the day in the display area (room 124/5, adjacent to the auditorium)

Welcome and Announcements: 9:45 a.m.

Featured Speaker 10:00 a.m.

Jeff Hester, Arizona State University
Understanding Our Origins: Formation of Sun-like Stars in Massive Star Environments
When most astronomers think of the formation of low-mass stars like the Sun, the environment that immediately jumps to mind is the Taurus-Auriga molecular cloud. Located at a distance of only 140 pc, Taurus-Auriga is the closest star forming region to the Sun and so provides the best opportunity for resolving the small-scale structures surrounding young low-mass stars. In this region star formation is a relatively quiescent affair in which stars form largely in isolation from the effects of other nearby stars. Convenience alone does not, however, necessarily mean that Taurus-Auriga is characteristic of the way that most low-mass stars form. Various lines of evidence indicate that the majority of low-mass stars form instead in much richer clusters and in the much more disturbed environments around massive stars. In particular, it is now clear that our own Sun and Solar System must have formed very near one or more massive stars. This conclusion comes from recent studies of meteorites that show there were significant amounts of iron-60 were present in the early Solar System. Iron-60 has a short half-life, and must have been produced locally near the time that the Solar System was born. The only astrophysically plausible source for that iron-60 is a nearby supernova. In this talk I will discuss the implications of this finding, following the stages in the early life of a low-mass star in a massive star forming environment, and considering the implications of this environment for the evolution of our Solar System.

Oral Session I: 11:00 a.m. One-minute Summaries of Display Presentations
Poster presenters will have a chance to show one overhead transparency that highlights the research presented on their poster, and one minute to introduce the research presented in the display area.

Lunch and Poster Display: 11:20 a.m. – 2:15 p.m.

Oral Sessions II & III are after lunch

A list of area dining establishments will be available in the display area. There are two Subways near GTCC – about a mile in either direction. Two establishments, Kaffini's (sandwiches, pastries, coffee, soups, etc.) and Zeko's of Sedgefield (pizza, pasta, subs, burgers, and wings - formerly Sedgefield Pizza) have offered meeting discounts – show your meeting programs when you ask for the discount.

Display Sessions

Posters can be set up before the 10:00 talk. The display area will be open for browsing during 11:20-2:15 and 3:15-3:45.

D1 Michael Rutkowski, Hampden-Sydney College
A Look at SNR 1E0102.2-7219 After Six Years with Chandra
An oft-studied remnant in the SMC, 1E0102.2-7219 has been used over the lifetime of the Chandra X-Ray Observatory as a calibration device for the onboard spectroscopic and imaging instruments. During this time the Smithsonian Astrophysical Observatory has archived over 2 Ms worth of good data on the remnant. While at Harvard-SAO with the summer REU program, I made use of this wealth of data in a review of a remnant. This review focused primarily on the possible detection of a neutron star or central compact object within the remnant, and also on efforts to re-calculate E0102's expansion rate. Additionally, the review provided new insight into the spatial distributions of H-like and He-like Ne, O, and Mg throughout the remnant.

D2 Chelsea MacLeod & Justin Kirschbrown, UNC-Chapel Hill
Undergraduates Chasing Gamma-Ray Bursts with PROMPT
Under an NSF grant, we worked for Dan Reichart on the PROMPT project. This involved learning how to take data with the PROMPT telescopes, using IRAF to reduce the data and perform photometry to obtain resulting magnitudes and flux measurements, and submitting GCNs to announce our results. We learned how to be prepared to take images when a GRB was detected by SWIFT, which involved using Skynet or manually operating the telescopes through remote desktop. Overall, we gained knowledge of what steps to take to analyze data from a GRB, and the experience necessary for a career in astronomy.
URL for this research: http://www.physics.unc.edu/~reichart/prompt2.html

D3 Adam Blythe Smith and Daniel B. Caton, Appalachian State University
Discovering the Secondary Eclipse and Physical Parameters of the Eclipsing Binary Star System V1898 Cygni
As part of a program of photometry of eclipsing systems, we serendipitously discovered the unknown secondary eclipse of the binary star system V1898 Cygni. Previous to our discovery, successive primary eclipses were thought to be primaries followed by equal depth secondaries. Since the discovery and the determination of the system's true period, we have continued using the Dark Sky Observatory's 18" telescope to obtain images of the system at all phases of its orbit, observing through three different color filters to provide information that is used to determine stellar temperatures. Using astronomical image processing software (Mira), we reduced the data to get a full light curve of the system-a plot of the brightness versus orbital position. These light curves were then analyzed using a computer modeling program (BinaryMaker3), which produces a synthetic light curve to compare to the observed data. An initial solution is presented here.

D4 Michael Castelaz, Pisgah Astronomical Research Institute
PARSEC: A UNC Research Center at PARI
Poster to accompany PARSEC Oral Presentation

D5 Don Cline and Michael Castelaz, Pisgah Astronomical Research Institute
PARI Education and Research Programs
The Pisgah Astronomical Research Institute (PARI) is a not-for-profit public foundation founded in 1999. PARI has acquired and developed a former NASA tracking station located in Western North Carolina as a radio and optical astronomy research and educational opportunities for a broad cross-section of users. In the six years since its founding, PARI has grown by developing educational programs that have impacted thousands of K-16 students. The programs are hands-on experimentally based, mixing disciplines in astronomy, computer science, engineering, and multimedia. The basic tools for the educational programs include a 4.6m radio telescope accessible over the Internet, a StarLab planetarium, and remotely accessible optical telescopes. As the next step in its growth, PARI is developing collaborative research programs. The research programs take advantage of the existing infrastructure that primarily consists of two 26m radio telescopes, a 12m radio telescope, office and lab space, fiber optic connectivity, and power backup. The current state of instrumentation, plans for their improvement, and major research and educational programs will be presented.
URL for these projects: http://www.pari.edu/programs/

D6 Mel Blake, Michael Castelaz, and Joe Phillips, Pisgah Astronomical Research Institute
The North Celestial Pole Monitoring Project
In the past ten years a renaissance has occurred in the study of transient phenomena using small, dedicated optical telescopes. This has largely been driven by the successful detection of planetary transits with small telescopes (Henry et al. 2000) and the successful recovery of optical afterglows of gamma ray bursts (e.g. Halpern et al. 1997). The telescopes involved are designed to slew at rapid rates accurately across the sky when a burst alert occurs, or to study a single patch of sky to detect transits. We have constructed a dedicated robotic instrument to monitor the region within 4 degrees of the north celestial pole continuously every clear night. Using a sequence of short and long exposures the telescope collects data to conduct searches for transient and variable objects and monitor the Cepheid variable Polaris. Previous authors (Kamper et al. 1984; Evans et al. 1998) have observed Polaris to nearly cease its pulsation, a unique behavior for a Cepheid variable. Monitoring Polaris with high secular coverage should help explain this behavior. We describe here the design of the observatory, its operation and control systems and give preliminary examples of the data products from this unique project.
URL for this research: http://www.pari.edu/telescopes/OpticalTelescopes/polaris

D7 Michael Castelaz, Don Cline (PARI), Elizabeth Griffin (Dominion Astrophysical Obsy), Wayne Osborn (Central Michigan Univ)
Preserving America's Photographic Heritage - Phase 1
Our shared heritage of some 3 million photographic observations is seriously in jeopardy, and astronomy may well lose vital, unrepeatable data dating back over a century. A call for preservation of astronomical plates has been made by the international astronomical community. This project is in response, and aims to establish a national archive for astronomical plates at the Pisgah Astronomical Research Institute that will preserve and eventually digitize selections of the plate collections in North America. Our poster describes details of the storage, cleaning and cataloging procedures that have been planned, and provides an overview of what is anticipated for succeeding Phases.
URL for this project: http://www.pari.edu/library/

D8 Michael Castelaz (PARI), Lorraine Walsh, Mary Anna LaFratta (UNCA), David Moffett (Furman)
A Collaborative Astronomy Project between Multimedia and Physics Undergraduate Majors
During the summer of 2004, faculty and undergraduate multimedia and physics interns from the University of North Carolina at Asheville and nearby Furman University joined together at the Pisgah Astronomical Research Institute to develop a new education and public outreach program of radio astronomy by utilizing the StarLab portable planetarium system. The program consists of three components: the StarLab cylinder for projection of the radio sky; display of a pulsar on the radio sky; and teaching and learning materials accessible through the Internet and CD-ROM. The multimedia and physics interns worked together to articulate and communicate aspects of their disciplines as they related to the development of the cylinder, the depiction of the pulsars and pulsar projector, and classroom activities for teachers and students. As a result, the cylinder depicts the radio sky and illustrates five distinct types of radio sources. The cylinder is augmented further through the use of an audio-visual pulsar projector, which emits pulses with sound for the audio-visually challenged. The activities present teachers with lesson plans related to radio astronomy topics. We discuss the unique development by this team needed to accomplish the programs first year goals. We acknowledge support from the NSF Internship in Public Science Education program grant number 0324729.

D9 Don Cline, Pisgah Astronomical Research Institute
Two 26 Meter Radio Telescopes for Long-Term Monitoring Programs and Surveys
Pisgah Astronomical Research Institute, a not-for-profit public foundation, operates two 26 m radio telescopes separated by 300 m on a nearly east-west baseline. The two alt-alt mounted 26 m radio telescopes have been completely refurbished with new motion controllers for precise pointing and tracking. The telescopes have completed a period which includes repeated observations of radio sources at 1420 MHz to improve pointing accuracy. The pointing models include parameters such as orthogonality of the axes, east-west axis orientation, and flexure. We present the results of the pointing models that have produced a factor of 10 improvement. Also, the prime focus assemblies will be described. The radio telescope on the west edge of the baseline has a 6.7 GHz receiver that occupies the center of the focal plane and a 1420 MHz receiver that is offset 20 arcminutes from the center. The eastern 26 m radio telescope has a 327 MHz receiver for pulsar research. The focus assemblies are rooms about 3 m on a side and contain power, fiber optics, and multiple coax signal cables which provide reconfiguration flexibility of multiple feeds and electronics assemblies.

D10 David Moffett, Furman University
Pulsars at PARI: An Update
A second prototype of PARI's 327-MHz receiver has been constructed with the goal of timing and monitoring the flux density of bright, northern pulsars. Two new sampling systems are available at PARI for recording pulsar data: the USRP by Ettus Research and the SDR-14 by RFSpace. We present observations of four pulsars recorded by the SDR-14, including Crab pulsar giant pulses.

D11 Scott Swindell, North Carolina A & T University
Line of Sight Column Densities of Polars
The presentation will explore the visualization and analysis of the accretion streams in polars using the results of computational stream models. IDL<http://www.rsinc.com/idl/index.asp>will be used as a platform for the developement of a series of tools that will allow visualization of the geometry, density and velocity structure within the stream as well as some interactive analysis tools to extract relavent phase dependant information from the stream models.

Afternoon Oral Sessions

Oral Session II: 2:15 p.m. PROMPT & PARSEC

Dan Reichart, UNC-Chapel Hill
PROMPT Update and Access
The University of North Carolina at Chapel Hill is building the six 0.41-meter diameter Panchromatic Robotic Optical Monitoring and Polarimetry Telescopes (PROMPT) at the Cerro Tololo Interamerican Observatory (CTIO) in the foothills of the Chilean Andes on behalf of the PROMPT Collaboration. Now one year into the project's building phase, I will summarize the state of the project and our plans to open access to PROMPT Collaboration institutions on January 1, 2006.
URL for this project: http://www.physics.unc.edu/~reichart/prompt2.html

Drew Foster, UNC-Chapel Hill
Skynet
Last year, the University of North Carolina at Chapel Hill presented an early version of a remote robotic telescope control software system designed for automated queue scheduling and rapid Gamma Ray Burst (GRB) follow-up. This year, we will present a near-final version of this software system, appropriately named Skynet. This application is able to control an n-node distributed network of robotic telescopes and automatically respond, on a never before seen, rapid-timescale to satellite-triggered GRB notifications. Features like weather monitoring, telescope dome control, and an advanced error diagnosis and notification system make Skynet a robust and reliable application. Aside from directing data collection on GRB's, Skynet's web-based interface will allow members of the FUNGRB collaboration to submit their own data acquisition requests, which will be automatically scheduled, carried out, and archived by idle telescopes on the network.
URL for this project: fungrb.physics.unc.edu

Michael Castelaz, Pisgah Astronomical Research Institute
PARSEC: A UNC Research Center at PARI
The Pisgah Astronomical Research and Science Education Center (PARSEC) is administered by UNC-Asheville for the benefit of each university within the 16-campus University of North Carolina system. PARSEC promotes and coordinates usage of the facilities at the Pisgah Astronomical Research Institute (PARI), a not-for-profit public foundation in the Pisgah Forest southwest of Asheville, NC. PARSEC benefits include: 1) intellectual capital formation, fostering new opportunities for science research and education; 2) economic stimulus in Western North Carolina through an influx of grants, job creation and visitors; 3) creation and transfer of knowledge through research, education and public service activities; and 4) instrumentation-intensive environment for students pursuing careers in the sciences, mathematics and engineering, rivaled by few other facilities in the U.S. An introduction to PARSEC, update on implementation, and examples of current UNC programs at PARI will be discussed.
URL for this project: http://parsec.unca.edu/

Break 3:15-3:45 p.m.

Posters on display in room 124/5

Oral Session III: 3:45 p.m. Assorted Short Research Presentations

Joshua Haislip, UNC-Chapel Hill

Discovery and identification of the very high redshift afterglow of GRB050904

We present the discovery of GRB 050904 using the SOAR and PROMPT telescopes in Chile. With a redshift of 6.29, this burst sets the record as the most distant explosion yet known. This discovery provides evidence that bright, high redshift gamma ray bursts exist and can serve as excellent probes of the early universe. Through the use of multi-wavelength imaging, it is possible to quickly identify such bursts and by triggering larger telescopes with even more capabilities, such as spectroscopy, a wealth of information about the early universe can be obtained.

URL for this research: http://xxx.lanl.gov/pdf/astro-ph/0509660

Donald Smith, Guilford College

The ROTSE World-Wide Telescope Network

With NASA's Swift satellite providing rapid and accurate coordinates for Gamma-Ray Bursts, a new window has been opened to study the physics of these massive explosions. The Robotic Optical Transient Experiment uses four identical 45 cm telescopes to image GRBs within ten seconds of the arrival of a trigger. The resulting light curves, especially in conjunction with observations by other instruments at different wavelengths, show diverse behavior that challenges standard models of burst evolution. We have a growing bestiary of bursts that lack the bright, early flash associated with a reverse shock in the relativistic ejecta, and our most recent acquisition (GRB 050801) shows an unusual very early achromatic break that the standard model cannot explain. Once again, GRBs are revealing themselves to be very complex and elusive phenomena.

URL for this research: http://www.rotse.net

Anatoly Miroshnichenko, UNC-Greensboro

***From Stars to Life: Expanding the List of Cosmic* Dust Producers**

Life in the Universe owes its origin to stars, which produce heavy elements by fusion and bring them to the interstellar space. Evolved cool stars are considered to be the main formation sites of cosmic dust, which later becomes planetary systems and eventually seeds of life. Until recently, it was thought that very luminous hot stars can also form dust in their powerful ejecta, but in much smaller amounts. Our recent findings show that dust can be formed near a significantly wider variety of hot stars. These objects may be important dust producers in the earlier and modern Universe. The newly discovered group of dust-forming hot stars will be presented, and the current state of their research will be discussed.

URL for this research: http://www.uncg.edu/~a_mirosh/hswd/

Mel Blake, Pisgah Astronomical Research Institute

An Investigation of the Period Change of the Contact Binary AH Cnc

We have identified an unusual feature in the light curve of the contact binary AH Cnc in M67. the feature appears as a brightening after maximum light, and may be due to a hot spot from infalling material or a sheet of material giving a short time-scale brightening. If mass transfer is the cause we should see a larger than normal period change in AH Cnc. Combining our new data with those from the literature we measure the period change of AH Cnc and show that the period change is not unusually high. The nature of the bright spot is still uncertain.

Brian Dennison, UNC-Asheville

The Dedicated Interferometer for Rapid Variability

The Dedicated Interferometer for Rapid Variability (DIRV) will utilize the two 26-meter radio telescopes at PARI to carry out long-term, fully-sampled monitoring of compact extragalactic radio sources. A series of recent observations has revealed a rich and unexpected phenomenology in the rapid variations of these objects. The dominant mechanism underlying the fastest variations is evidently scattering by spatial fluctuations in the density of the intervening ionized interstellar medium. In addition, very rare Extreme Scattering Events (ESEs) can only be detected and studied through dedicated monitoring of a large sample of compact sources. Detection of ESEs by DIRV can trigger critical follow-up observations with other facilities, including high resolution VLBI imaging, HI absorption, optical photometry, etc. The DIRV project will involve development of dual-polarization receiver systems at S and X band. In the control room, the signals will be converted to digital form and correlated using a highly parallel architecture configured on Field Programmable Gate Array (FPGA) chips. The development of DIRV is a PARSEC/PARI collaboration, funded by NSF grant 0520928 to UNCA.