Student Talks

May 31 Thursday	Jun 1 Friday	Jun 2 Saturday
The hybrid AGN core of 3C 111 -- Sandra de Jong (François Arago Centre, APC, Université Paris Diderot)	The VERITAS Upgrade -- Sajan Kumar (University of Delaware)	Improving Fermi Resolution to Probe for the Intergalactic Magnetic Field -- Brendan Wells (University of California, Santa Cruz)
Multi-wavelength Observations of PKS 2142-75 during an Active and Quiescent Gamma-Ray State -- Michael Dutka (Catholic University of America)	A Model for Cosmic Ray Interactions in M82 -- Tova Yoast-Hull (University of Wisconsin)	Multi-TeV electron measurement with the CREST experiment – Nahee Park (University of Chicago)

Abstracts:

The hybrid AGN core of 3C 111
Sandra de Jong (François Arago Centre, APC, Université Paris Diderot)

To shed light on the physical processes that produce high-energy emission in the non-blazar radio galaxy 3C 111 we analyzed both the X-ray spectrum in between 0.4 and 200 keV and the broad-band spectral energy distribution of this source using archival and previously unpublished data from Suzaku, INTEGRAL, Swift and Fermi/LAT. The combined Suzaku, Swift and INTEGRAL data are represented by an absorbed exponentially cut off power law with reflection from neutral material with a photon index $\Gamma = 1.68 \pm 0.03$, a high-energy cut-off $E_{cut} = 227^{+143}_{-67}$ keV, a reflection component with $R = 0.7 \pm 0.3$ and a Gaussian component to account for the iron emission line at 6.4 keV with an equivalent width of $EW = 85 \pm 11$ eV. The X-ray spectrum appears dominated by thermal, Seyfert-like processes, but we cannot exclude a non-thermal component. The radio to gamma-ray spectral energy distribution can be fit with a single-zone synchrotron- self Compton model, with no need for an additional thermal component. The broad-band emission is of non-thermal, blazar-like origin, whereas the X-ray spectrum shows both thermal components (reflection, iron line) and non-thermal components (the iron line is weak and variable). Furthermore the high-energy cut-off can be interpreted as either an

exponential cut-off of the thermal spectrum or as a turn-over of the non-thermal spectrum. Therefore we suggest a hybrid model to explain the broad-band non-thermal emission and the thermal component in the X-ray spectrum.

Multi-wavelength Observations of PKS 2142-75 during an Active and Quiescent Gamma-Ray State
Michael Dutka (Catholic University of America)

PKS 2142-758 is a flat spectrum radio quasar. It is a weak gamma ray emitter which is occasionally detected on daily time scales in the MeV through GeV energy range. Gamma ray flares have been detected on April 4th 2010, Oct-Nov 2010 and July-August of 2011. Quasi- simultaneous observations across the electromagnetic spectrum are essential to create SEDs which are essential to understand the origin and nature of high energy emission from AGN. During the latest flaring period and a gamma ray quiescent period, multi wavelength observing campaigns were carried out using the Ceduna radio telescope, the Australian Telescope Compact Array (ATCA), the TANAMI VLBI Array, Swift, and the Rapid Eye Mount Telescope (REM). We will present quasi simultaneous spectral energy distributions while the source is in active and quiescent gamma ray states and discuss the implications of this data assuming a leptonic model for blazar emission.

The VERITAS Upgrade
Sajan Kumar (University of Delaware)

To improve the instrument sensitivity, and to better address our science goals, we are in the process of upgrading the cameras of the VERITAS array of Cherenkov telescopes with high efficiency photomultiplier tubes. We are also investigating the use of shortpass optical glass filters on the telescopes, as a means to allow observations under bright moonlight, thus increasing the duty cycle of the array. I will report on the status of the upgrade and the filter tests, and discuss our plans for the future.

A Model for Cosmic Ray Interactions in M82
Tova Yoast-Hull (University of Wisconsin)

From first principles, we construct a simple model for the evolution of energetic particles in the starburst galaxy M82. Assuming constant cosmic-ray acceleration efficiency with Milky Way parameters, we calculate the cosmic-ray proton and primary & secondary electron/positron populations. From the cosmic-ray spectra, we can predict the radio synchrotron and gamma-ray spectrum. To more accurately model the radio spectrum, we incorporate a multiphase interstellar medium in the starburst region of M82. The spectra for this simple model are compared to the observed radio and gamma-ray spectra of M82. Chi-squared tests are used to compare with radio observations to find the best-fit parameters. The best-fit model yields constraints on the magnetic field strength and advection speed for the starburst zone in M82. Fermi detections of M82 provide additional constraints for the advection speed. Through this project, we aim to check the calorimeter model, in which energetic particles lose most of their energy within the galaxy. We also explore whether we can apply our knowledge of cosmic ray acceleration and propagation as we understand them in the Milky Way to starburst systems.

Improving Fermi Resolution to Probe for the Intergalactic Magnetic Field
Brendan Wells
(University of California, Santa Cruz)

Theories of large scale structure formation indicate that the intergalactic magnetic field (IGMF) plays an important role in the development of galaxies and clusters. However, the IGMF is extremely small and difficult to detect—both upper and lower limits have been set, but thus far no undisputed value has been measured. Surprisingly, gamma-rays offer an important probe through observations of "Pair Halos", faint and diffuse objects surrounding the brightest AGN. Pair halos are smaller than the current resolution of the Fermi LAT, but a novel error analysis technique will allow us to extract the maximum information from each detected photon. This will improve resolution for transient, diffuse, or faint sources where individual photons have significant impact, including pair halos.

1 Slide Intros

Students not giving a talk are encouraged to present 1 slide about their background and research interests.

Jun 4 Monday	Jun 5 Tuesday	Jun 6 Wednesday	Jun 7 Thursday
Chris Anelli (University of Maryland, College Park)	Jacob Daughhetee (Georgia Tech)	Sol Molina (Instituto de Astrofísica de Andalucía, CSIC)	Sheetal Saxena (University of Wuerzburg)
Ralph Bird (University College Dublin)	Simone Dichiara (University of Ferrara)	Paul Moran (National University of Ireland, Galway)	Karlen Shahinyan (University of Minnesota)
Francesco Borracci (Max Planck Institute for Physics, Munich)	Sean Griffin (McGill University)	Alexis Popkow (University of California, Los Angeles)	Christian Skole (DESY, Zeuthen)
Carolina Casadio (Instituto de Astrofísica de Andalucía, CSIC)	Caitlin Johnson (University of Minnesota)	Dmitry Prokhorov (Stanford University)	Dylan Kee (University of Delaware)
James Casey (Georgia Tech)		Greg Richards (Georgia Tech)	