Meeting of Astronomers in South Carolina

April 23, 2016

Conference Schedule

Oral Presentations

8:30 – 9:30	**Registration**
Session 1	
9:30 – 9:50	**Steven Rodney (USC)** Stellar Explosions, Strongly Lensed
9:50 – 10:10	**Varsha Kulkarni (USC)** Probing the Most Gas-rich Galaxies with Super-damped Lyman-alpha Absorbers in Quasar Spectra
10:10 – 10:30	**Vaidehi Paliya (Clemson)** Broadband observations of High Redshift Blazars
10:30 – 11:00	**Break and Poster Viewing**
Session 2	
11:00 – 11:20	**Francie Cashman (USC)** The Chemical Evolution of Galaxies and Relevant Atomic Physics
11:20 – 11:40	**Marco Ajello (Clemson)** The Origin of the Gamma-ray Background
11:40 – 12:00	**Stefano Marchesi (Clemson)** The z>3 AGN Space Density of the Chandra COSMOS Legacy Survey
12:00 – 1:00	**Lunch and Poster Viewing**
Session 3	
1:00 – 1:20	**Aman Kaur (Clemson)** The Puzzling Bulge to Disk Nova Ratio in the Andromeda Galaxy
1:20 – 1:40	**Don Walter (SCSU)** CATE: From Indonesia to South Carolina
Final Business and Conference Adjournment	

Poster Presentations

Sarina Etheridge (C of C)	Contrasting Magnetohydrodynamic Turbulence with Alpha-Viscosity in Black Hole Accretion
Suraj Poudel (USC)	Reaching Back To The First Billion Years Of Cosmic Chemical Evolution: Magellan Mike Observations Of High-Redshift Damped Lyman-Alpha Absorbers
Daniel Smith (SCSU)	Cosmological Parameter Estimation from CMB Data for Undergrads
Amber Porter (Clemson)	Spectropolarimetry Reveals Asymmetries in SN Ia 2014J Near Maximum Light

MASC 2016

Program and Abstracts

8:30 – 9:30 Registration

Session 1

9:30 Steven Rodney (University of South Carolina)

Title: Stellar Explosions, Strongly Lensed

In recent years the Hubble Space Telescope has been extending its reach into the early universe by targeting massive galaxy clusters that act as cosmic telescopes: using gravitational lensing to amplify the light of distant objects. This makes it possible to detect the explosions of stars that formed when the universe was less than a few billion years old. It also yields a small but special sample: highly magnified supernovae that serve as sensitive probes of the lensing cluster's dark matter potential. I will describe some of the exciting discoveries from this program, including a highly magnified Type Ia supernova, a peculiar fast transient observed twice in a multiply-imaged galaxy, and an ancient supernova being multiply imaged by both a galaxy and a galaxy cluster.

9:50 Varsha Kulkarni (University of South Carolina)
Co-Authors: Debopam Som, Sean Morrison, Celine Peroux, Samuel Quiret, and Donald York

Title: Probing the Most Gas-rich Galaxies with Super-damped Lyman-alpha Absorbers in Quasar Spectra

Understanding how galaxies acquire gas and how they convert it into stars are among the key themes in galaxy evolution. We are addressing various aspects of these questions using spectroscopy and imaging of distant quasars to probe the galaxies along the lines of sight. I will describe clues from recent work on the spectroscopy of the strongest of the quasar absorption systems, i.e. super-damped Lyman-alpha systems. These systems represent the most gas-rich galaxies in the distant universe and have significant star formation rates and molecule content.

10:10 Vaidehi Paliya (Clemson)
Co-Authors: M. L. Parker, A. C. Fabian, and C. S. Stalin

Title: Broadband observations of High Redshift Blazars

Using the quasi-simultaneous NuSTAR & Swift telescope observations and by performing the broadband spectral energy distribution modeling, we study the general physical properties of four high redshift blazars and compare them with a large sample of blazars. They are found to lie at the high end of the accretion disk luminosity and the jet power regime. The observed soft X-ray deficit, a feature commonly seen in high redshift radio-loud quasars, can be explained due to intrinsic curvature in the jet emission rather than other external effects. The details of the results will be presented.

10:30 – 11:00 **Coffee Break, Poster Viewing**

Session 2

11:00 Francie Cashman (University of South Carolina)
Co-Authors: V. P. Kulkarni (USC), R. Kisielius (Institute of Theoretical Physics & Astronomy, Vilnius University, Lithuania), G. J. Ferland (Dept. of Physics & Astronomy, University of Kentucky), and P. Bogdanovich (Institute of Theoretical Physics & Astronomy, Vilnius University, Lithuania)

Title: The Chemical Evolution of Galaxies and Relevant Atomic Physics

Galactic evolution is driven by attempting to understand the physical and chemical processes that transform a progenitor galaxy's gaseous mass into stars. Surveying and studying galaxies at different epochs is essential to understanding how galaxies evolve. It is imperative to know what chemical elements are present and their relative abundances as we look to higher redshifts. Atomic spectroscopy is used to study these galaxies since they usually have strong absorption features when viewed along the line of sight of a distant quasar. Careful identification and measurement of the observed absorption lines in the spectra of these quasar absorption systems yields the elemental abundances. Absorption line studies rely on atomic data because the observed lines are the result of electric dipole transitions. These transitions are characterized by the absorption oscillator strength, or f-value, which is the probability that electromagnetic radiation is absorbed or emitted for an atomic energy level transition. Therefore the field of atomic physics and observational astronomy are more closely intertwined than most realize. We are currently producing a compilation of oscillator strengths for key transitions for wavelengths long-ward of 911.753 Angstroms. This compilation focuses on the recent findings from numerous theoretical and experimental physicists for ions of astrophysical interest that have been observed in the ISM/CGM/IGM for selected

elements ranging from C to Pb. It is essential to use the most accurate atomic data possible when translating the spectroscopic measurements from observations into physical quantities that provide crucial constraints on models of galaxy evolution.

11:20 Marco Ajello (Clemson)

Title: The Origin of the Gamma-ray Background

In this talk I will review the topic of the gamma-ray background and how it can inform us on some of the most powerful and exotic phenomena in the Universe, including dark matter annihilation and the origin of the recently detected IceCube neutrino flux.

11:40 Stefano Marchesi (Clemson)

Title: The z>3 AGN Space Density of the Chandra COSMOS Legacy Survey

I present the largest high-redshift (3< z<6.85) sample of X-ray-selected active galactic nuclei (AGN) on a contiguous field, using 174 sources detected in the Chandra COSMOS Legacy survey. I will show the AGN space density at z>3 in two different luminosity bins, comparing the results obtained in this work with those of previous surveys and with the predictions of phenomenological models of X-ray background. I will also present the space density evolution dividing our sample in optically classified Type 1 and Type 2 AGN. Finally, I will show the comparison between the Chandra COSMOS Legacy space density and the predictions of quasar activation merger models, calibrated with optically luminous AGN.

12:00 – 1:00 **Lunch, Poster Viewing**

Session 3

1:00 Aman Kaur (Clemson)

Title : The Puzzling Bulge to Disk Nova Ratio in the Andromeda Galaxy (M31)

Novae in M31 are often associated with the bulge component of the light from this galaxy, i.e., more novae are assumed to be produced in the bulge of M31. But examining this from a population synthesis approach, one expects that evolved binaries in the disk should produce more novae. We strive to understand this bulge to disk nova ratio puzzle in M31 by exploring two scenarios. The nova rate normalized to the K-band luminosity for different galaxy Hubble types is approximately constant. We utilize this observed correlation to model the bulge and

disk nova distribution. However, the decomposition of K light into bulge and disk does not yield a good match to the observed spatial distribution of novae in M31. Therefore, we conclude that the assumption that the nova rate follows total K light is too simple to explain the actual distribution of novae in this galaxy. Second, we examine the role of dust in the disk of M31 in extinction novae, possibly more so in the disk, which would increase the relative number of observed bulge novae compared to those in the disk. We construct a three dimensional multi-component dust model (uniform background, 10 kpc ring, 2 logarithmic spirals) and apply it to novae in the bulge and the disk of M31. With model parameters calibrated from infrared emission models, this results in hiding only ~ 1 % of the novae in the disk and 0.3-0.4 % in the bulge. We, therefore conclude that dust in M31 does not play a significant role in shrouding novae in the disk. In fact, the effect of the dust is not much higher for disk novae in comparison to bulge novae. Therefore, we conclude that the common assumption that "novae trace the K-band light" is not supported by the detailed spatial models of novae in M31, and that extinction by dust is insufficient to resolve the puzzle of the relative scarcity of disk novae in M31.

1:20 Don Walter (South Carolina State University)
Co-Authors: Myles McKay, Jennifer Cash, and Daniel Smith (South Carolina State University)

Title: CATE: From Indonesia to South Carolina

The Citizen Continental America Telescope Eclipse (CATE) Experiment will include between 60 and 100 identical telescopes stationed across the path of totality during the eclipse of August 21, 2017. These sites will be distributed from the Oregon coast to South Carolina, acquiring images of the solar corona and providing 90 minutes of continuous coverage of the dynamics of the solar corona during totality. Sites will be operated by a collection of scientists, students and citizen scientists.

The March 2016 total solar eclipse in Indonesia was used as a trial run of the equipment to be used in August 2017 event. Five teams from CATE traveled to Indonesia, including a student-faculty pair from South Carolina State University. We present the results of our observations from that trip as well as plans for the 2017 event. This work is supported by a subaward from AURA to SC State under NASA award NNH15ZDA0043C.

1:40 Post-Meeting Discussion

Poster 1

Sarina Etheridge (College of Charleston)
Co-Authors: P. Chris Fragile (College of Charleston), Bhupendra Mishra (Nicolaus Copernicus Astronomical Center of the Polish Academy of Science, Warsaw, Poland)

Title: Contrasting Magnetohydrodynamic Turbulence with Alpha-Viscosity in Black Hole Accretion

A black hole accretion disk is an accumulation of materials, such as gas and dust, which orbits a black hole. The goal of this project is to create two separate computer simulations of black hole accretion disks. The two computer simulations will use different methods of producing the turbulence that is required for accretion disks to operate.

One of the simulations will use an artificial viscosity put in "by hand." This implies that this method is not a representation of true viscosity, but merely acts like viscosity. No physical mechanism is truly represented. This is how accretion disks have been modeled for decades. The other simulation will incorporate the physical process now known to be responsible for accretion, called the magneto-rotational instability.

The purpose of the project is to compare the two simulations to understand in what ways the real physical process differs from the artificial viscosity treatment. Ours will be the first such simulations done using general relativistic gravity, as is appropriate near a black hole.

Poster 2

Suraj Poudel (University of South Carolina)
Co-Authors: Varsha Kulkarni (USC), Debopam Som (Laboratoire d'Astrophysique de Marseille, formerly USC), Sean Morrison (USC), Celine Peroux (Laboratoire d'Astrophysique de Marseille), Donald York (Univ. of Chicago)

Title: Reaching Back To The First Billion Years Of Cosmic Chemical Evolution: Magellan Mike Observations Of High-Redshift Damped Lyman-Alpha Absorbers

Sub-damped Lyman-alpha absorption lines in the spectra of distant quasars are produced by gas-rich galaxies along the sightlines. Over the past few years, our team has established the sub-DLAs as an important class of galaxies that may contain a significant fraction of the cosmic metal content. The cosmic evolution of these intringuing objects is still not well-determined since the high-redshift sub-DLA samples are small. Here we will present Magellan MIKE spectra of quasars with high-redshift sub-damped Lyman-alpha absorption systems. The primary goal of these observations is to determine the chemical composition and kinematics of the absorbing gas.

Poster 3

Daniel Smith (South Carolina State University)

Title: Cosmological Parameter Estimation from CMB Data for Undergrads

Cosmology has become, over the last several years, a precise science due to Cosmic Microwave Background (CMB) data from the WMAP and Planck missions. Extracting early universe physics from that data has, however, been largely left to experts, but that need not be the case. Analyses of CMB data suitable for undergrad physics majors will be presented. For example, CMB data can be used in conjunction with theoretical curves generated by NASA's CAMB Web Interface tool to determine the curvature parameter. Also, the matter parameter can be approximated by fitting the peaks of the CMB power spectrum to theoretical approximations in previous literature.

*Supported by NSF PAARE AST-0750814

Poster 4

Amber Porter (Clemson)

Title: Spectropolarimetry Reveals Asymmetries in SNIa 2014J Near Maximum Light

The aspherical nature of a supernova explosion can be explored through spectropolarimetric observations which capture the degree of polarization of the source as a function of wavelength. Multi-epoch observations of Type Ia supernovae have found low polarization across the continuum with significant polarization in some spectral features. Thus, the general picture is of a globally symmetric explosion with asymmetrically distributed ejecta.

Using the CCD Imaging/Spectropolarimeter (SPOL) at the 90" Bok and 6.5-m MMT telescopes, we obtained multi-epoch observations of the Type Ia supernova SN 2014J from maximum light to 111 days past-maximum. We find a total polarization spectrum that is steeply falling with wavelength. This is presumably interstellar in origin, but implies dust properties quite di_fferent from those in the Milky Way. After this is removed, the polarization shows very little overall asymmetry as revealed by low continuum measurements. Ejecta asymmetries, however, are revealed through moderate levels of time-variable polarization in accordance with the Si II absorption line. At maximum light, the line polarization reaches _ ~0.6% before evolving into a multi-peaked feature one week later indicating that this particular ion has a more complex geometry.

Registered Participants

Marco Ajello	Clemson
William Baker	Furman
Nassim Beiranvand	USC
Francie Cashman	USC
Susan D'Amato	Furman
Bryan DeMarcy	USC
Abhishek Desai	Clemson
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Aman Kaur	Clemson
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Lea Marcotulli	Clemson
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Vaidehi Paliya	Clemson
Amber Porter	Clemson
Suraj Poudel	USC
Steven Rodney	USC
Daniel Smith	SCSU
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