# **2019 Spring Meeting** of the **Astronomical Society of New York**

Saturday, March 16, 2019

**The University at Albany**

Lecture Center 19 (ground floor of the podium)

## Arrival

9:00 - 9:30am: Arrival and Poster Setup - Coffee and Tea

## Welcome

9.30am: Welcoming Remarks (Cecilia Levy & Charles Liu)

## Morning Session A

9:45am: ***Kronoseismology: Using Saturn's rings to probe its internal oscillations.***
Phil Nicholson (Cornell)

10:25am: ***Modeling The Thermal Radiation of Exoplanets***
Jennifer L Carter (Union)

## Morning Break

10:40 - 11:15am: Coffee Break

## Morning Session B

11:15am: ***AGN in SED Fitting: The Dependence of Stellar Mass and Star Formation Rate in COSMOS Galaxies***
Krystal Tyler (RIT)

11:30am: ***An Update on The Colliding Winds of WR140***
Joshua Thomas (Clarkson)

11:45am: ***Exploring Halo Substructure With Blue Horizontal Branch Stars***
Paul Amy (RPI)

## Lunch

12:00 - 1:00pm: Lunch

## Afternoon Session

1:00pm: ***Dark Matter: or looking for a needle in a haystack***
Cecilia Levy (UAlbany)

1:40pm: ***The Snowball Chamber: A Supercooled Approach to Dark Matter Detection***
Joshua Martin (UAlbany)

1:55pm: ***The Role of Environment and Redshift on the Star Formation - Stellar Mass Correlation in the COSMOS Field***
Kevin Cooke (RIT)

2:10pm: ***LSST: An Update As First Light Approaches***
Charles Liu (CUNY-CSI)

## Afternoon Break

2:30 - 2:50pm: Coffee Break

## Poster Session

2:50 - 5:00pm: Poster Presentations

***Automated Surface Photometry of Galaxies in Groups***
Aiyana Poulin (Union)

***Looking for Extended Red Emission in LDN1780 and NGC7023***
Carlie Fowler (Clarkson)

***Field Extreme Horizontal Branch (EHB) Stars***
Robert Gryncewicz (RPI)

***The Virgo Overdensity Explained***
Tom Donlon (RPI)

***Measuring the Mass of the Pisces-Perseus Supercluster with the APPS Survey***
Helen Black (Union)

***Exoplanet Transits Observed at the Union College Observatory: An EXOFAST Analysis***
Jake Feinstein, Christos Kakogiannis, Georgia Mraz (Union)

***Effects of Galaxy Interactions on AGN Activity at 0 < z < 3***
Ekta Shah (RIT)

***Observations of Koronis Family Asteroids during 2017-19 at the Union College Observatory***
Jason Sindoni (Union)

***LZ: THE DARK MATTER EXPERIMENT***
Nishat Parveen (UAlbany)

***Transient Follow-up Using the Siena 0.7m Telescope***
James Agostino (Siena)

***Spectroscopic and Photometric Data From Siena College's 0.7 Meter Telescope***
Coley Stillman (Siena)

***Exploring AGN Unification Theory with the LOFAR Two-metre Sky Survey***
Gaia Fabj (CUNY-CSI)

***Heat Conduction Versus Thermal Radiation of Halo Gas***
Jerry Ortiz (CUNY-CSI)

## ABSTRACTS

### *Kronoseismology: Using Saturn's rings to probe its internal oscillations.*

Phil Nicholson, Cornell University

In previous work (Hedman & Nicholson 2013, 2014, French et al. 2016) we have used stellar and radio occultation data from the Cassini spacecraft to identify inward-propagating density waves in Saturn's C ring with resonances generated by internal f-mode oscillations in Saturn. The oscillations involved are sectoral modes (ie., modes with l = m) with m = 2, 3, 4 and 10, as originally predicted by Marley & Porco (1993). An improved geometric solution for Cassini occultations, accurate to ~150m, has now led to the identification of an additional seven Saturn-driven waves in the inner C ring, four of which appear to be vertical waves with odd values of l-m (French et al. 2019). Furthermore, new phase-corrected wavelet techniques have revealed six more saturnian density waves in the middle C ring with m = 5, 6, 7, 8, 9 and 11 (Hedman et al. 2019). These advances provide a more complete picture of the spectrum of planetary normal modes and thereby place strong constraints on Saturn's internal structure and rotation rate (Mankovich et al. 2019). Puzzles remain however, including the existence of multiple modes with m = 2 and 3.

### *Modeling The Thermal Radiation of Exoplanets*

Jennifer L Carter, Union College

High precision exoplanet light curves offer the opportunity for detailed exoplanet characterization. We have moved beyond the realm of simply determining the radius and orbital period of an exoplanet and are now able to measure parameters such as the exoplanets reflectivity and temperature. In particular, characterizing the temperature of an exoplanet provides information about its potential for habitability. Currently, only very hot exoplanets can have their temperatures directly estimated, but exoplanet heat maps can be estimated from light curve data. One method assumes that the exoplanet may be characterized by a day side and a nightside temperature where each side of the exoplanet emits thermal blackbody radiation at a single temperature. In this work, I will describe a new method of characterizing the thermal emissions of exoplanets by considering N temperature zones, as opposed to the dayside/nightside model used previously. The zones make up a series of rings centered along the line connecting the center of the exoplanet to the center of its host star. Each ring will be treated as a black body with constant temperature and the zone with the greatest temperature will be that closest to the sub-stellar point. I will present a comparison of this new model to dayside/nightside model. Finally, I will discuss the precision necessary to differentiate these temperature variations from the dayside/nightside model using light curve data.

### *AGN in SED Fitting: The Dependence of Stellar Mass and Star Formation Rate in COSMOS Galaxies*

Krystal Tyler, Rochester Institute of Technology

Galaxy evolution is a complex process that requires understanding of properties both intrinsic and external to galaxies. These properties, however, are not always easily observable; for example, star formation and AGN activity are dependent on observed wavelength, dust extinction, redshift, metallicity, etc. To study galaxies in detail requires extensive multiwavelength sampling of galaxies' spectral energy distributions and the inclusion of a variety of models for comparison. In this talk, I will discuss the importance of far-IR observations and the effects of AGN templates on galaxy properties in SED fitting.

### *An Update on The Colliding Winds of WR140*

Joshua Thomas, Clarkson University

With the aid of an international collaboration of amateur astronomers, I present 162 optical spectra of the Wolf-Rayet/O-star binary system WR140. Radial Velocities for both stars in the binary have now been fully measured with the new data. The WR140 system has an orbital period of 7.9 years and recently underwent a close periastron passage in December 2016. This close passage shows signs of colliding winds and triggered dust formation, which becomes visible as excess emission in many of the high-velocity wind lines. These results are compared to the previous periastron passage in 2009. WR140 is one of only two Wolf-Rayet systems with a visual orbit. Our aim is to refine the orbital parameters and better constrain the stellar masses. In addition some new, unexpected, optical variations were observed near hydrogen Balmer alpha.

### ***Exploring Halo Substructure With Blue Horizontal Branch Stars***

Paul Amy, Rensselaer Polytechnic Institute

Blue horizontal branch (BHB) stars are commonly-used and effective tracers for mapping substructure in the halo of the Milky Way (MW) through the identification of distance and kinematic overdensities. We use spectroscopically identified BHB stars from the Sloan Digital Sky Survey (SDSS) to identify and fit orbits to tidal debris streams, including Hermus and Hyllus. In addition, we develop new methods to search for streams, including methods that combine distance and line-of-sight velocity in a way that is sensitive to star streams that are extended along our line of sight. These streams are under-represented in the list of known halo substructures. Inclusion of new data, particularly from the Gaia mission, can improve our ability to isolate and analyze tidal streams. This project was funded by a Rensselaer Presidential Fellowship, NSF grant AST 16-15688, the NASA/NY Space Grant fellowship, and contributions made by The Marvin Clan, Babette Josephs, Manit Limlamai, and the 2015 Crowd Funding Campaign to Support Milky Way Research.

### ***Dark Matter: or looking for a needle in a haystack***

Cecilia Levy, University at Albany

The search for dark matter, an elusive particle that makes up ~25% of the universe, encompasses elements of cosmology, astronomy and particle physics. In this talk I will give a brief overview of the field and how we are trying to truly detect a needle in a haystack.

### ***The Snowball Chamber: A Supercooled Approach to Dark Matter Detection***

Joshua Martin, University at Albany

The cloud and bubble chambers have historically been used for particle detection, capitalizing on supersaturation and superheating respectively. We present now on the snowball chamber, which utilizes a supercooled liquid. In our prototypes, an incoming particle triggers crystallization of purified water. We demonstrate that water is supercooled for a significantly shorter time with respect to control data in the presence of AmBe and 252Cf neutron sources. A greater number of multiple nucleation sites are observed as well in neutron calibration data, as in a PICO-style bubble chamber. Similarly, gamma calibration data indicate a high degree of insensitivity to electron recoils inducing the phase transition, making this detector potentially ideal for dark matter searches seeking nuclear recoil alone. We will explore the possibility of using this new technology for that, updating everyone on new results that will be a prelude of our newest generation tests.

### ***The Role of Environment and Redshift on the Star Formation - Stellar Mass Correlation in the COSMOS Field***

Kevin Cooke, Rochester Institute of Technology

The star formation within a galaxy has been observed to correlate well with its host's stellar mass over large samples. This star formation rate - stellar mass correlation, or Star Forming Main Sequence (SFMS), has been examined in the local universe and at high redshift, but many questions remain as to how it evolves. For example, do dense local environments suppress star formation rates at the same masses or to the same degree as it does at low redshift? What populations dominate the suppression of star formation at high stellar masses? The answers to these questions will address the role of the local environment and the evolution of quenching behavior with redshift. To investigate this important correlation, I use all galaxies observed in the COSMOS field above the stellar mass completeness limit of the COSMOS2015 catalog. For each galaxy, I construct spectral energy distributions from the FUV-FIR and fit these SEDs with stellar and dust components using MAGPHYS. By plotting the median star formation rate over stellar mass for samples defined by redshift, local environment, and NUVrJ colors, we address how different galaxy populations experience quenching.

### ***LSST: An Update As First Light Approaches***

Charles Liu, City University of New York - College of Staten Island

The Large Synoptic Survey Telescope (LSST) is scheduled for first light within the year, and each observing night between 2022 and 2032 it will generate one thousand 9-square-degree images, 15,000 gigabytes of data, and an estimated 10,000,000 observing alerts. I will present a brief status report on the construction of the LSST observing site, telescope, and instrumentation, and preview its operations and observing plans, with the hope of emphasizing how each of us can plan to participate in the tremendous scientific and technological potential of this extremely ambitious and quickly-approaching astronomical juggernaut.

### *Automated Surface Photometry of Galaxies in Groups*

Aiyana Poulin, Union College

The Undergraduate ALFALFA Team Groups Project measures environmental effects on star formation for galaxies in groups. We are exploring an automated measuring process based on the galaxy reduction package Source Extractor. Results from this process are compared with results from the Union College interactive analysis method for 79 galaxies from the galaxy groups NCG5846, NRGb027, NRGb032, NRGb137, and NRGb151. Images were obtained at the Kitt Peak National Observatory using the WIYN 0.9m telescope. Each group contains galaxies truncated in star formation rates; higher truncation rates tended to occur in denser groups. This work was supported by NASA NY Space Grant and NSF AST-1637339.

### *Looking for Extended Red Emission in LDN1780 and NGC7023*

Carlie Fowler, Clarkson University

Extended Red Emission (ERE) is a poorly understood optical photoluminescence that occurs in areas that contain interstellar dust and far-ultraviolet photons. It is thought that this process occurs only in areas that are mostly carbon-rich, rather than oxygen-rich. It is currently thought that ERE is produced by ionized polycyclic aromatic hydrocarbons, although there are contending theories. To get more insight into the ERE, two nebulae thought to exhibit this phenomenon were observed at Clarkson's Reynolds Observatory. A previous study in the literature shows that ERE was thought to be detected in LDN1780, but this original finding has not yet been confirmed. Further analysis will be done using other nebula that may or may not show extended red emission. Knowing the characteristics of nebulae that exhibit ERE will help solve a longstanding question in astrophysics about the chemical composition of the source of ERE.

### *Field Extreme Horizontal Branch (EHB) Stars*

Robert Gryncewicz, Rensselaer Polytechnic Institute

EHBs are identified as the extreme blue end of the horizontal branch in H-R diagrams of globular clusters. We present a method that is promising for identifying EHB stars in the field, using spectra and photometry from the Sloan Digital Sky Survey (SDSS) Data Release 14 matched with Gaia DR2. We then use these candidate EHB stars in the first quadrant to trace halo substructure. We identify a structure that could correspond to the the northern end of the Hercules-Aquila Cloud (HAC), at a distance of roughly 10 to 20 kpc from the Sun.

## *The Virgo Overdensity Explained*

Tom Donlon, Rensselaer Polytechnic Institute

We suggest that the Virgo Overdensity (VOD) of stars in the stellar halo is the result of a radial dwarf galaxy merger we call the Virgo Radial Merger. Because the dwarf galaxy passed very near the Galactic center, the debris has a large range of energies, but nearly zero Lz angular momentum. We connect different parts of this merger debris to the Perpendicular and Parallel Streams, the Hercules-Aquila Cloud (HAC), and possibly Eridanus Phoenix Overdensity. This radial merger can explain the majority of the observed moving groups of RR Lyrae and blue horizontal branch stars that have previously been identified in Virgo. We explore the possibility that this merger also explains the Gaia-Enceladus and Gaia-sausage debris discovered in the solar neighborhood. Orbits are provided for the Virgo Radial Merger progenitor and the Cocytos Stream, which was also recovered in the same region.

## *Measuring the Mass of the Pisces-Perseus Supercluster with the APPS Survey*

Helen Black, Union College

The Arecibo Pisces-Perseus Supercluster Survey (APPSS) is a project to determine the mass of the Pisces-Perseus Supercluster by measuring peculiar velocities of galaxies near the supercluster. The velocities of the galaxies are determined using HI observations obtained at Arecibo Observatory. I present reduction and analysis of APPSS HI spectral data of 177 targets in a slice at declination 29 degrees to obtain velocities and identify members of the supercluster. 49% of the 177 target galaxies were detected. Of these detections, 66% are possible members of the Pisces-Perseus Supercluster. Optical observations obtained from the Sloan Digital Sky Survey are used to determine the distance of the galaxies via the baryonic Tully-Fisher relation.The Hubble component of the velocity can then be removed, providing the peculiar velocity for each galaxy. Analysis of the final sample of 2000 galaxies will be used to determine the supercluster's mass.

## ***Exoplanet Transits Observed at the Union College Observatory: An EXOFAST Analysis***

Jake Feinstein, Christos Kakogiannis, Georgia Mraz, Union College

We have performed data analysis of the transits of the exoplanets HAT-p-3b and WASP-3b using the program EXOFAST to determine if the Union College Observatory's 0.5 meter telescope and similar telescopes can use it as a tool of primary data analysis and modeling. Using data collected by past and present students, we have compared our results from EXOFAST to NASA database results. We used both chi-squared minimization and MCMC algorithms as the principle methods of statistical analysis for EXOFAST's results. We conclude that chi-squared analysis is adequate for quickly determining the caliber of the data imported and MCMC is best used to refine our model. We conclude that EXOFAST is a viable method for primary data analysis of exoplanet transit data for the Union College Observatory. This provides another tool to analyze and model exoplanet transits.

## ***Effects of Galaxy Interactions on AGN Activity at $0 < z < 3$***

Ekta Shah, Rochester Institute of Technology

Galaxy interactions and mergers play an important role in the evolution of galaxies. In the nearby universe, it has been shown that interactions have strong effects on galaxy properties like their star formation rates (SFRs), active galactic nuclei (AGN) activity, and morphology. We extend these studies to high redshift galaxies. Interactions at high redshift take place in already actively star-forming galaxies with a very high gas fraction as compared to local galaxies, which may significantly affect the efficiency of interactions to enhance the AGN activity in galaxies. We present the enhancement in AGN activity due to galaxy interactions for the largest known sample of spectroscopically confirmed major galaxy pairs (1265 for $v < 1000$km/s) at $0 < z < 3$ generated by using deep multiwavelength observations from the COSMOS and the CANDELS surveys. By studying and quantifying the effects of galaxy interactions, and their correlations, we can get a deeper understanding of processes taking place during galaxy interactions and how they change over cosmic time.

### *Observations of Koronis Family Asteroids during 2017-19 at the Union College Observatory*

Jason Sindoni, Union College

We discuss the changes that physical and orbital elements of Koronis Family asteroids undergo over a period of time. We obtained images and performed photometry of 1725 CrAO, 3032 Evans, 1835 Gajdariya, 2713 Luxembourg, 1443 Ruppina, and 1497 Tampere using the Union College Observatory throughout the 2017-2019 calendar year. We present light curves for each. Variations in the asteroid brightness are due to rotation on short time scales and the changing illumination and viewing angle due to orbital motion on longer time scale.

### *LZ: THE DARK MATTER EXPERIMENT*

Nishat Parveen, University at Albany

Dark matter makes up ~27% of the universe. There have been various attempts to search for dark matter. LZ (LUX-ZEPLIN) is one of the dark matter detection experiment merging LUX (Large Underground Xenon) and ZEPLIN (ZonEd Proportional scintillation in LIquid Noble gases). I would like to present about the experimental set-up, ongoing work and the progress LZ has made in its attempt to detect dark matter.

### *Transient Follow-up Using the Siena 0.7m Telescope*

James Agostino, Siena College

Siena College installed a 0.7m telescope recently which began operation in early fall, 2018. Calibrating, working through technical errors, and starting to accumulate data to begin to narrow down the capabilities of the telescope which is limited by both Siena and Albany's light pollution is an important step to being able to use the telescope at full capacity. Thus, I undertook a project that would tackle these problems, while also stimulate my scientific interests. Transients short-term astronomical events ranging from asteroids, to variable stars, to supernovae. They are defined as any object that changes brightness in the sky. The Zwicky Transient Facility, a precursor to the upcoming LSST, records these changes in brightness each night, and disseminates useful information on each event such as magnitude and coordinates. Using these public sets of data and Siena's 0.7m telescope, we have been able to follow up on these transient events at a range of magnitudes, and in turn are developing a standard for observing with and reducing data taken with the telescope.

## ***Spectroscopic and Photometric Data From Siena College's 0.7 Meter Telescope***

Coley Stillman, Siena College

With the installation of Siena College's new 0.7 meter telescope our capabilities for science and discovery have vastly increased. Currently the telescope is outfitted with an optical mirror and ccd. With this current setup we are limited to photometric and time series observations. There are numerous scientific implications of such a setup. With photometry we can measure the perceived brightness of an object and, in conjunction with time series data we can determine the accurate location of objects in the sky. We can also observe events such as supernova and asteroid migration. Despite the numerous capabilities we currently have we are still missing a large portion of data. This missing data includes spectra of objects, chemical composition, and redshift (which can give us distance). These parameters can only be realized with the use of a spectrometer. Siena College is currently looking into attaching a spectrometer to the telescope. There are many steps that we must go through first, however. Calibration is the main one as reading out the data would be useless without an appropriate calibration in which we compare our measured spectra to known spectra. An end goal of this project is create a data set that outlines the limitations and capabilities of Siena's telescope. Photometry can give us a magnitude range that our telescope can detect objects within. Our data can be compared to GAIA's second data release as that stands as the most complete data set of stars within our galaxy.

## ***Exploring AGN Unification Theory with the LOFAR Two-metre Sky Survey***

Gaia Fabj, City University of New York - College of Staten Island

Active Galactic Nuclei (AGN) are believed to be a result of accretion of matter by a supermassive black hole (SMBH) at the center of its host galaxy. Unification theory predicts that type 1 AGNs (quasars, QSO) and type 2 AGNs (radio galaxies, RG) can be unified as a single class based on the fact that they have the same intrinsic sizes. This would result in different observed projected linear sizes, being that these objects are oriented along different viewing angles. The goal of this project was to test the AGN unification theory by looking at the projected linear sizes of a selected sample of radio sources using a low frequency survey provided by the Low-Frequency Array (LOFAR), the LOFAR Two-metre Sky Survey (LoTSS). To test the theory, we looked at QSO and RG cumulative distribution functions (CDF) and at their size ratios as a function of low-frequency radio luminosity (151 MHz) and redshift.

### ***Heat Conduction Versus Thermal Radiation of Halo Gas***

Jerry Ortiz, City University of New York - College of Staten Island

For a warm gas cloud without velocity within hot halo gas, the internal energy of the warm gas cloud is regulated by two primary processes: energy gained through thermal conduction with the surrounding gas, and energy lost due to thermal radiation. The goal of this project is to determine the importance of conduction between the cloud and the surrounding medium. We tested a model with a spherical cloud of temperature 1.5 * 10^4 K at its edge, and a temperature of 106 K at the edge of the medium. For this scenario, the thermal conductivity (calculated as Spitzer conductivity), heat conduction, and thermal radiation was calculated, with fixed boundary temperatures, a constant pressure of 103 erg cm-3, and a metallicity ratio of Zg = 0.3. We wanted to determine the conditions under which the heat radiated outwards from the warm cloud equals the heat conducted from the hot medium into the cloud. Comparing the heat conduction with the thermal radiation will indicate which conditions are required for the warm gas cloud to heat up and eventually dissolve. Understanding this interaction can inform observations of halo gas and the circumgalactic medium.