GRAM

GEORGIA REGIONAL ASTRONOMY MEETING

Department of Physics and Astronomy
University of Georgia, Athens, GA
Friday and Saturday, October 27 and 28, 2017

Abstracts

Julius Benton (Association of Lunar and Planetary Observers) - *Alpo Saturn Observations* – TALK to be given by Ken Poshedley

With its truly magnificent rings, the planet Saturn exhibits many features that invite well-organized visual observations and imaging projects by amateur astronomers. Using instruments of moderate aperture in good seeing conditions, a series of bright zones and darker belts can be seen extending across the globe of Saturn roughly parallel to the equator, as on Jupiter, and the rings are subdivided into three main components, the outer two separated by Cassini's division. Although Saturn requires about twice the magnification needed for studies of Jupiter, the planet is far from being a dull and unchanging world, and remarkable detail in the rings and on the globe is routinely revealed by amateurs who image the planet using digital imagers and CCDs at various wavelengths. A brief compilation of results gleaned from over half a century of ALPO studies of Saturn are cited including the current 2016-17 apparition. A summary is given of current observing programs, including a continued appeal for more simultaneous visual observations, ideally concurrent with times when Saturn is being imaged. Several Professional-Amateur cooperative research programs are discussed, in particular the long term ALPO participation during the *Cassini* mission from April, 1, 2004 until the mission ended on September 15, 2017. Some of the more interesting observations of Saturn over several decades, including the current 2016-17 observing season, are described.

Gen Chiaki (Georgia Institute of Technology) – *The first matter cycle in the Universe: from the first stars to the next-generation of stars* – POSTER

The standard theory of structure formation in the Universe predicts that the astronomical objects are formed from the smallest units, stars, to more larger systems such as galaxies. The first-generation of stars (Pop III stars) are formed through the gas clouds without elements heavier than helium such as carbon and oxygen, which accounts for ~2% of total gas mass in the present-day Universe. The heavier elements, called `metal' in astrophysics, are first synthesized and dispersed by the supernovae (SNe) of Pop III stars, and incorporated into the newly formed clouds which will host the second-generation of stars (Pop II stars). We follow the first step of matter cycle by numerical simulations to predict the mass fraction of metal (metallicity) of Pop II star-forming clouds. In the outskirt of our Galaxy, ancient stars with metallicity less than a thousand of our neighborhood, so-called extremely metal-poor (EMP) stars are found. Our simulations show that the metallicity range of the Pop II star-forming clouds are consistent with that of EMP stars, and therefore EMP stars are originated from the metal pollution by Pop III stars.

Michael Covington (University of Georgia) – *Evaluating DSLR camera sensor performance for astronomy* – POSTER

Recent technical advances have made digital single-lens reflex (DSLR) cameras even more suitable for deep-sky imaging. Unlike other cameras they do not require tethering to a computer. DSLR sensors differ appreciably in a number of ways, especially post-amplification read noise. These posters review the important characteristics of sensor performance and describe tests and evaluations, including astronomical interpretations of tests published for conventional photographers.

David Dundee (Tellus Science Museum) – *Solar Eclipse over Tellus* – TALK

This presentation will detail the activities and logistics of hosting an eclipse event. Tellus Science Museum also entered into an exclusive contract with our local ABC affiliate, WSB-TV, to broadcast the total eclipse from a remote site back to the Museum and upload it to the TV viewing public.

Donnie J. Evans, Jay P. Dunn, and D. Michael Crenshaw (Georgia State University) – *A survey of excited state troughs in nearby AGN observed by COS* – POSTER

We use archival cosmic origin spectrograph (COS) spectra to explore the frequency (i.e., global covering factors) of absorption troughs due to excited, metastable state transitions for low ionization state species in nearby AGN ($z<0.1$). We find 95 targets observed by COS within this redshift limit and determine global covering factors of 0.02 and 0.01 for Si II and Si II*, respectively. While this is significantly lower than its higher ionization counterparts, this low rate of detection is possibily due to abundance and ionization state of the clouds.

Gregory Feiden (University of North Georgia) – *Magnetic fields in early stellar evolution* - TALK

Young low-mass stars often exhibit observational signatures of temperature anisotropies on their surface. These features, known as starspots, are thought to be the result of strong magnetic fields analogous to sunspots at the Sun's photosphere. Despite the apparent prevalence of starspots, and thus magnetic fields, on young stars, little is know about the role that magnetic phenomenon have in governing early stellar structure and evolution. After a brief introduction to stellar magnetisms and starspot formation theory, I will highlight efforts at the University of North Georgia to understand the influence that starspots and their magnetic fields have on the lives of young low mass stars. Emphasis will be placed on how these phenomena affect commonly accepted ages of young stellar systems.

Deborah Ferguson – (Georgia Institute of Technology) – *Apparent Horizon Dynamics of Binary Systems* – TALK

Black holes are incredibly compact objects whose gravity is too strong to allow even light to escape. They are defined by their event horizon, the boundary from within which nothing can escape to infinity. This definition of the event horizon makes them impractical computationally; therefore, NR uses a local but coordinate dependent horizon called the apparent horizon which if found, is guaranteed to lie on or within the event horizon. The apparent horizon defines the outermost marginally trapped surface (a surface on which the expansion of light is zero). During the coalescence of a binary black hole system, a final apparent horizon forms during the merger, and it is possible for the horizons of the two individual black holes to continue to exist as inner marginally trapped surfaces after the common horizon is formed. Understanding the dynamics of these marginally trapped surfaces provides insight into the behavior of space-time in extreme gravity limits. In this talk, I will explore what we know about these marginally trapped surfaces and discuss their implications.

David Garofalo (Kennesaw State University) – *The strange and as yet unexplained behavior of the most massive black holes in the Universe* - TALK

After more than 5 decades observing quasars, observational techniques have improved so dramatically that we now see hundreds of thousands of such objects across vast stretches of space and time. While theory and observation converge on a picture of quasars as the phenomenon of gas falling into supermassive black holes at the center of large galaxies, observed black holes seem to be doing something that theory does not predict. Less than a decade ago, astronomers at the Harvard-Smithsonian Astrophysical Observatory explored over 60 thousand quasars in the Sloan Digital Sky Survey and identified a strange and as yet unexplained feature which is that while most quasars emit enormous amounts of energy albeit quite close to their theoretical limit, the most massive black holes appear to be less capable of reaching this limit. While this seems to violate our basic ideas about what black holes can do, we present a possible solution that leaves our basic theoretical paradigm unchanged, albeit with a twist.

Sudarshan Ghonge (Georgia Institute of Technology) – *Multi-Network: Looking at gravitational waves through multiple eyes* - TALK

GW170814 was the fourth Gravitational Wave (GW) event to recorded by the LIGO detectors located in the United States. This event is unique however, because it is also the first event to be detected by Advanced Virgo detector in Pisa, Italy. The addition of a third detector had major consequences on our ability to analyze GW events. My talk will focus two aspects of this. The first is Sky localization of the source. The uncertainty in the sky localization using data from the two LIGO detectors alone was 1160 sq degrees while that using whole Ligo Virgo network was 60 sq degree - a factor of 20 times improvement. The second is our understanding of the Gravitational wave polarization. General Relativity (GR) predicts that the space-metric perturbations posses two degrees of freedom. Till GW170814, our ability to test this was limited due to the relative closeness of the LIGO detectors. The addition of Virgo in Europe, allowed us to explore different combinations of the polarizations. The simplest phenomenological tests overwhelmingly favored tensor polarizations over scalar and vector polarizations consistent with GR.

Louis Gonzales (Georgia State University), Allison J. Smith (University of Georgia), and Loris Magnani (University of Georgia) – *OH 18 cm Observations of the Intermediate Velocity Molecular Cloud G211+63* - POSTER

We have conducted a survey of hydroxyl (OH) at 18 cm in the Intermediate Velocity Molecular Cloud (IVMC) G211+63. IVMCs are molecular clouds with | v_{LSR} |, independent of Galactic rotation, between 20 and 90 km/s. These objects are rare with only seven known examples (the most notable being the Draco cloud complex). We detected OH 1667 MHz emission from 6 of 8 observed positions using the Arecibo 305 m radio telescope. These are the first detections of hydroxyl in an IVMC and they are also detections of the OH 1667 main line at the lowest E(B-V) level to date: 0.08 mag. The column densities and abundance of OH in this object are typical of diffuse and translucent molecular clouds.

Jeffrey Gritton (Georgia Southern University) – *Magnetohydrodynamic High Velocity Clouds* – TALK

High velocity clouds (HVCs) interact with their surroundings resulting in the evolution of the cloud through fragmentation, erosion, evaporation, ablation, and condensation. In addition to the hydrodynamic interactions HVCs experience magnetohydrodynamic effects that can affect their evolution. In order to examine these effects over long periods of time, we made detailed 3-dimensional magnetohydrodynamic FLASH simulations of massive HVCs (1.35×10^5 $M_\odot$ to 1.35×10^6 $M_\odot$) traveling through hot, low density media with a uniform magnetic field like that in the extended Galactic halo for 200 Myr. We find that magnetic fields can provide a suport mechanism to protect a cloud against erosion and fragmentation. We discuss the effects of including magnetic fields on HVCs as it pertains to the cloud mass, cloud volume, and cloud speed.

Jessica Hamilton (University of North Georgia) – *Star spots and their impact on observable stellar properties* - POSTER

Star spots are areas on a star's optical surface that are cooler than the surrounding ambient surface due to the hindrance of convection by magnetic fields. We test how the presence, surface coverage fraction, and temperature contrast of star spots affect a star's position in multiple color-magnitude diagrams. Using a phenomenological model for the impact of spots on stellar structure, we investigate changes in stars' color, temperature, and brightness and their correlation to spot properties assuming different energy redistribution mechanisms. Our tests have the potential to delineate between different theoretical models of star spot formation, which will lead to better a understanding of star spot physics and how spots affect stars' observable properties.

Corey Haun – (Georgia Scientific Network) – *Learn, Teach, and Do with tools that are powerful, open, and free* - TALK

Bhavesh Khamesra (Georgia Institute of Technology) – *Binary Black Hole Simulations* – POSTER

With the recent detections of binary black holes, there has been a rising interest in the area of gravitational wave astronomy. These waves carry information about their sources which make their study quite relevant. This information is extremely important from theoretical and astrophysical perspectives. While there are several data analysis methods employed to extract this information, they often take a lot of time and computational resources. Further, these are often followed by numerical relativity simulations which again require information about these sources. In this work we try to approach this problem using methods from Machine Learning as they are quite efficient and much faster compared with current methods. We use various machine learning algorithms to extract initial parameters of binary holes using a bank of gravitational waveforms and study the correlations between them.

Amy Lovell, Brynn Presler-Marshall, and Aysha Rahman (Agnes Scott College) – *A radio OH survey of comets* – POSTER

Comets provide a unique opportunity to study the early solar system. Made of roughly 80 percent water ice and 20 percent silicate dust and other materials, understanding the composition of comets is critical to understanding the formation of the solar system. Ground-based observations using the 100 meter Green Bank Telescope and 305 meter Arecibo telescope allow us to map and model the gas production rates and outflow velocities of 20 comets as they near perihelion. We provide here preliminary results regarding the gas production rates and velocity of the OH molecules in a typical comet based on data that spans 16 years and over 30 comets. Our molecule velocities range from 0.47 km/s to 3.273 km/s while our gas production rates cover three orders of magnitude from 0.36 to 123.9 $\times 10^{28}$ molecules/second.

Bethe Newgent and Jay P. Dunn (Georgia State University) – *The potential nature of FeLoBAL winds as seen through variability* – POSTER

We conduct a study of FeLoBAL quasars observed by the Sloan Digital Sky Survey (SDSS) to explore variability of BAL troughs. We searched through the SDSS archives and find 35 objects with spectra from multiple epochs. Three of the objects with multiple epochs show variability in the BAL troughs. In each case, the BAL substructure is evident and agrees in velocity space between ions of all ionization levels. The changes appear to only specific subcomponents more clearly seen in the low ionization species. Given the correlation between isolated troughs in low ionization states and blended features in high ionization states, we argue that the physical structure of the BAL wind is likely clumpy in nature.

Khai Nguyen (Georgia Institute of Technology) – *Diagnostic power of broad emission line profiles in searches for binary supermassive black holes: Comparison of models with observations* - TALK

Motivated by observational searches for sub-parsec supermassive black hole binaries (SBHBs) we develop a semi-analytic model to describe the spectral emission line signatures of these systems. We are particularly interested in modeling the profiles of the broad emission lines, which have been used as a tool to search for SBHBs. The goal of this work is to test one of the leading models of binary accretion flows in the literature: SBHB in a circumbinary disk. In this context, we model SBHB accretion flows as a set of three accretion disks: two mini-disks that are gravitationally bound to the individual black holes and a circumbinary disk that forms a common envelope about a gravitationally bound binary. Our first generation model shows that emission line profiles tend to have different statistical properties depending on the semi-major axis, mass ratio, eccentricity of the binary, and the alignment of the triple-disk system, and can in principle be used to constrain the statistical distribution of these parameters. We present the results of a second generation model, which improves upon the treatment of radiative transfer by taking into account the effect of line-driven winds on the properties of the model emission line profiles. This improvement allows a preliminary comparison of the model profiles with the observed SBHB candidates and AGN population in general.

John O'Neal (Association of Lunar and Planetary Observers) – *Resolution in Arc Seconds for Common Diameter Telescopes and How Seeing Affects Resolution* - POSTER

I present a handy chart to illustrate:
A) *How the Resolution in Arc Seconds increases as the objective diameter increases.*
B) *How the Resolution in Arc Seconds increases as the observed wavelength decreases.*
This chart also illustrates how different scopes and wavelength filters might be utilized under differing seeing conditions. By comparing the "Resolution in Arc Seconds for Common Diameter Telescopes" Chart to the "Mount Wilson Seeing Scale in Arc Seconds" you can determine what diameter scopes will work best for the current seeing conditions.

KwangHo Park (Georgia Institute of Technology) – *Accretion onto Black Holes in the presence of radiative feedback* - TALK

Accretion of gas and the interaction of matter and radiation are at the heart of many astrophysical questions pertaining to black hole growth and the coevolution of massive black holes and their host galaxies. Thus, numerical simulations of radiation-regulated accretion onto black holes are essential in understanding how the ionizing radiation that emanates from the innermost region of the black hole accretion flow couples to the surrounding medium and how it regulates the black hole fueling. In this talk, I will discuss the role of radiative feedback in regulating gas accretion onto massive black holes. In particular, I will stress our recent progress on 1) radiation-driven turbulent accretion flow using 3-dimensional radiation-hydrodynamic simulations and 2) gaseous dynamical friction for black holes in supersonic motion.

Ken Poshedley (Association of Lunar and Planetary Observers) - will give Julius Benton's talk

Dave Pranav (Georgia Institute of Technology) – *Iron peak elements in Type Ia SNR 3C 397* –TALK

Recent Suzaku X-ray spectra of Type Ia SNR 3C 397 indicate enhanced stable iron-group element abundances of Ni, Mn, Cr, and Fe. We compute nucleosynthetic yields from a suite of multidimensional hydrodynamics simulations to explore the parameter space offered by single degenerate Type Ia models. Varying the progenitor white dwarf internal structure, composition, ignition, and explosion mechanism, we find the best match to the observed iron-peak elements of 3C 397 are dense (central density ≥ 6×10 ^ 9 g/cm ^ 3), low-carbon white dwarfs that undergo a weak, centrally-ignited deflagration, followed by a subsequent detonation. The amount of Ni56 produced is consistent with a normal or bright normal Type Ia SN.

Theo Ramakers (Atlanta Astronomy Club) – *An unorthodox way of looking at high solar energy* – TALK

Mike Reynolds (Association of Lunar and Planetary Observers & Florida State College at Jacksonville) – *The Great American Eclipse* – TALK

An overview of the August 21, 2017, Total Solar Eclipse as submitted by the members of the Association of Lunar & Planetery Observers. This eclipse was the most-observed and photographed total solar eclipse in history, and much of the total eclipse path enjoyed excellent weather.

Max Roberts (University of North Georgia) – *Decoding the evolution of young stars: A look at magnetic fields* – POSTER

Magnetic fields are hypothesized to affect the fundamental properties of young stars by increasing their size and cooling their surface temperature, as compared to stars without magnetic fields, at a given age. However, observational evidence supporting this hypothesis is scarce and is largely based on comparison of stellar evolution models that include effects from magnetic fields with a few select young stellar systems. Therefore, to expand on current knowledge, we present initial results from an effort to produce a large grid of magnetic stellar evolution models suitable for modeling young stellar systems of any age or metallicity. Once completed, the model grid will permit more rigorous tests of the hypothesis that magnetic fields affect the physical properties of young stars.

Tim Robertson (Association of Lunar and Planetary Observers) - *The ALPO Podcast The Observers Notebook* - TALK

A discussion on what is a podcast and why the ALPO started one if the first place. We will look into the current subjects covered such as:

- The History of Amateur Astronomy in the US
- Individual Section biographies within the ALPO
- The 2017 Total Solar Eclipse
- The 2017 Orionids Meteor Shower
- The ALPO Training Program

As well as what is coming in the future and looking at the worldwide audience that is currently listening to the podcast. Tim will show you how to login and subscribe to the Observers Notebook and stay up to date with the latest in the world of the ALPO. The podcast is available on iTunes, Stitcher, SoundCloud, GogglePlay or anywhere else you can download a podcast. In addition a brief discussion on how the podcast is financed using PATREON, an online service to assist in funding the podcast by having listeners donate a monthly amount to help support the online presence.
You can contact Tim Robertson at cometman@cometman.net
You can follow the podcast on twitter at: @ObserversNBPod

Richard Schmude (Gordon State College) – *J and H band photometry of Venus* - TALK

The writer carried out 275 J and H filter brightness measurements of Venus between May 2014 and September 2017. These filters probe lower portion of Venus' atmosphere. The normalized brightness values, J(1,□) and H(1,□), follow:

$$J(1,\square) = -5.061 - 0.5637\square + 2.6056\square^2 - 0.697\square^3$$

$$H(1,\square) = -5.112 - 0.4531\square + 2.5031\square^2 - 0.7835\square^3$$

where □ is the solar phase angle of Venus. (The normalized brightness of Venus is the brightness that planet would have if it were 1.0 au from the Earth and Sun.) The writer was also interested in detecting any bright or dark regions as a function of the sub-Earth longitude. The data were broken up into 60° longitude intervals and mean deviations from the equations were measured. There was no significant statistical difference for the J filter but the longitude region 120° – 180° W was found to be brighter than surrounding areas at the a=0.05 confidence level based on t-Test calculations.

Lauren Sgro, Inseok Song, and Tara Cotten – (University of Georgia) - *The Infrared Excess of TYC 6213-1122-1* - POSTER

The Tycho-2 star TYC 6213-122-1 has recently been identified as a source of infrared excess emission. We use new data from the Stratospheric Observatory for Infrared Astronomy (SOFIA) at 7.7 and 34.8 μm to conduct further analysis on TYC 6213-1122-1 and confirm the unusual amount of dust around this star. With SOFIA data, the spectral energy distribution of the star and dust suggest the presence of a warm dust disk in addition to a dominant cold disk. Modeling suggests a sizable dustless region between the two disks, which is likely indicative of planetary activity. Proper motions, trigonometric distance, and an age estimation to qualify TYC 6213-1122-1 as a member of the Upper Scorpius subregion of the ScoCen Association. Additional calculations result in a fractional infrared luminosity of $L_IR/L_{*} = 0.25 for this star, suggesting that a quarter of the stars light is intercepted by circumstellar material. We discuss the implications of such a large fractional infrared luminosity and scenarios that may be responsible.

Robin Shelton and Jason Galyardt (University of Georgia) - *What Happens to a High Velocity Cloud When it Hits the Milky Way's Disk: Is Dark Matter Necessary for Survival?* – POSTER

Dark matter halos enshroud some of the most massive high velocity clouds. Their gravitational pull confines the clouds as they pass through the intergalactic medium. Given the ability of dark matter halos to stabilize their embedded baryonic clouds against hydrodynamic interactions that would otherwise disrupt them, it has further been suggested that dark matter halos could enable high velocity clouds to survive impacts with the Milky Way's disk. The survival of high velocity clouds, such as the Smith Cloud, during a passage through the disk has been cited as evidence for the presence of dark matter. However, a second actor, the magnetic field, may also be at play. In order to characterize, measure, and disentangle their effects, we have performed magnetohydrodynamic simulations of massive high velocity clouds as they impact a galactic disk. Here, we present the rate at which material dissipates in a variety of situations that include or exclude dark matter and magnetic fields.

Pamela Shivak – (Association of Lunar and Planetary Observers) – *Reaching out with social media* – TALK

Deirdre Shoemaker – (Georgia Institute of Technology) – *Black Holes and Gravitational Waves: Einstein's Legacy* – FRIDAY NIGHT PUBLIC LECTURE

Gravitational Waves Detected! Merging Black Holes! Not only are these seemingly fantastical concepts making headlines, predicted by Einstein's theory of gravity 100 years ago, these concepts are in reality important components of the Universe. I will give an introduction to both the theory of black holes and the evidence for their existence in the Universe. I will highlight their role in the recent discoveries of gravitational waves by LIGO and discuss some of the compelling qualities that intrigues students of all ages.

Karelle Siellez – (Georgia Institute of Technology) – *The multi messenger era: from Gravitational Waves to Gamma Ray Bursts* - POSTER

Gamma-ray bursts are the most energetic explosions in the universe. Those jets of high-energy gamma rays travel at the speed of light to reach the Earth and inform us about their central engine. They are thought to be released by the merging of neutron stars. Those progenitors are also thought to produce Gravitational Waves, deformation of Space-Time predicted by Einstein and observed by the detectors LIGO/Virgo. Binary Black Hole mergers were the progenitors of all the Gravitational Waves observed by LIGO/Virgo. I am part of the team of LIGO who is looking for coincident event between the Gravitational Waves emission of Binary Neutron Star merger and their electromagnetic counterpart (GRB). I will present the different methods used to hunt those coincident events, the kind of analysis I realized to achieve this goal in the LIGO team of the Center for Relativistic Astrophysics and the consequences for the future of those detections. Entering the multi messenger era will help us solve a lot of mysteries on the fundamental properties of those progenitors.

Maurice Snook and Julie A. Luft (Russell Research Center and University of Georgia Department of Mathematics and Science Education) *Solar Eclipse Outreach: An Amateur Astronomer's Odyssey* – TALK

The Total Solar Eclipse of Aug. 21, 2017 presented numerous challenges to the school systems for maximizing educational opportunities along with minimizing safety concerns. This talk will discuss the successes and limitations of various modes of public outreach utilized to alert the public, especially the school systems of Northeast Georgia, of the impending solar eclipse. We wanted to avoid a repeat of 1984, when students were locked in their classrooms. Our initial goal, to alert and educate teachers and administrators about eclipse safety, evolved into providing options for allowing safe viewing of the eclipse with "eclipse glasses" and offering eclipse information, both scientific and historical. Since the eclipse would occur only two weeks after schools opened, it would not have been possible to visit them all. For this reason, other options for information dissemination to schools were explored. Representatives of UGA Dept. of Mathematics and Science Education, Clarke County School Board and Northeast Georgia Regional Educational Service Agency (RESA) enabled information to be sent throughout the state of Georgia. Public outreach centered on: (1) presentations at libraries throughout Northeast Georgia; (2) local newspaper coverage; (3) festivals, local civic organizations and other venues.

Ryan Tanner (Augusta University) – *Scaling relation saturation for Galactic winds* - POSTER

Star formation inside galaxies can generate massive galactic outflows or winds. Some recent surveys of star forming galaxies have shown that the outflow velocity correlates with the star formation rate (SFR), while other surveys have found no correlation between SFR and outflow velocity. Using 3D hydrodynamical simulations of galactic winds I resolve this discrepancy to show that outflow velocity saturates and no longer scales with increasing SFR. The limit is set by the central mass loading of the star forming region.

Clark Veazey (University of Georgia) – *Computational investigations of He-HD collisions in the Interstellar Medium* -TALK

In order to interpret spectroscopic data collected on astronomical objects, it is necessary to have a background of accurate dynamical information on interstellar molecules at one's disposal. Seeing as most of the observable infrared radiation in the universe is emitted by molecules excited by collisional processes in the interstellar gas, generating accurate data on the rate of molecular collisions is of salient interest to astronomical endeavors. The collisional system we will be focusing on here is He-HD, an atom-diatom system in which He collides with HD. We are primarily interested in the cooling capabilities of this system, as these species are predicted to have played an important role in the formation of primordial stars, which emerged from a background composed solely of Hydrogen, Helium, and their compounds. HD is being investigated because it has a finite dipole moment and is hence a powerful radiator, and He due to its relative abundance in the early universe. Using a hybrid OpenMP/MPI adaption (vrrm) of a public-domain scattering package, cross sections for He-HD collisions are computed for a swathe of both rotational and vibrational states across a range of relevant kinetic energies, then integrated to produce rate coefficients.

Matthew L. Will (Association of Lunar and Planetary Observers) – *The Association of Lunar and Planetary Observers, Solar System astronomy at its finest* - TALK

The Association of Lunar and Planetary Observers is an international organization of amateur observers that record scientific observations of solar system bodies and their phenomena. This presentation is an overview of the ALPO, its purpose and mission, giving insights into its operations and how one can join and participate in our organization.

Ziwei Zhang (University of Georgia) – *Non-LTE analysis of CO and SiO: A case of O-rich AGB stars* - TALK

The circumstellar envelopes (CSE) of asymptotic giant branch (AGB) stars are known for their complex chemistry and unique physical structure. AGB stars are characterized by C/O ratio, with O-rich for C/O < 1, C-rich for C/O > 1 and S-type for C/O ≈ 1. CO is abundant and important for gas-phase studies of AGB stars, while SiO is one of the signature molecules for O-rich AGB stars and highly related to dust condensation in CSEs. Here we present Non-LTE abundance and spectral analysis of CO and SiO in O-rich AGB stars using radiative transfer code RADEX and photoionization spectral simulation code Cloudy. Both codes work with LAMDA molecular database for collisional rate coefficients due to H2, H and He impact. Previously, CO and SiO have pure rotational data at vibrational ground state with one or two colliders due to the limitation of theoretical computation. We expanded rate coefficients for both molecule up to v=5 and J=40, as well as more colliders included. With our comprehensive data, we're expecting to improve our understanding of various astrophysical environments.