	Plenary Presentation	Abstract
9:00 a.m.	***Multifaceted Views of Exoplanet Systems*** Rebekah Dawson Penn State University	Over the past couple decades, thousands of extra-solar planets have been discovered orbiting other stars.The exoplanets discovered to date exhibit a wide variety of orbital and compositional properties; most are dramatically different from the planets in our own solar system. Our classical theories for the origins of planetary systems fail to account for the diversity of planets now known. In this talk, I'll discuss how multifaceted views of planetary systems — including orbital properties, system architectures, planetary compositions, and stellar properties — powerfully test theories for the origins and evolution of planetary systems. I will present results from simulations, comparisons to observed exoplanet populations and individual systems, and avenues for testing theories with ongoing and upcoming missions and surveys.
10:20 a.m.	**Poster Breakout Sessions**	**Poster Abstract**
	Photometric BVRI Observations and the First Analyses of the Bright Solar Type Binary V1063 Cassiopeia **Daniel Caton** (Appalachian State University), Ronald Samec (PARI), Danny Faulkner (Johnson Observatory)	CCD, BVRI light curves of V1063 Cas were taken on 15-18, 20, 31, October and 11-13, 14, 21 November, at the Dark Sky Observatory, Appalachian State University with the historical (installed 1981) 18" reflector, by Dan Caton, Ronald Samec, and Danny Faulkner. The variability of V1063 Cas was discovered in Northern Sky Variability Survey (NSVS, Wozniak et al., 2004, IBVS 5700). They reported an ephemeris of Min. I = 2451578.75215 + 0.6200 d*E, and identified the variable as TYC 4493-1966-1, and gave its position, d=01h 04m 47.254s, a=+70˚ 06' 13.59". It is classified as an EW contact variable with a V magnitude range of 11.2-12.0. Four times of low light were found in ASAS observations. Six times of minimum light are found in the literature. Our present observations, included one primary BVRI eclipse and three secondary eclipses. From these data, we determined the following linear and quadratic ephemerides, JD Hel MinI = 2457310.7335±0.0004d + 0.62000902±0.0000013×E (1) and JD Hel MinI = 2457310.7325±0.0004d + 0.62000990±0.00000019×E +0.000000000134± 0.000000000024×E2 (2). Thus, from our 28.4-year period study, the orbital period is found to be increasing. This could be due to mass transfer making the mass ratio decrease (q=M2/M1). A Wilson-Devinney analyses reveals that the system is a W-type (less massive component is the hottest) W UMa binary with a fairly extreme mass ratio, q=0.8084±0.0007, 1/q=M1/M2=1.24). Its Roche Lobe fill-out is ~33%. No spot was needed in the solution. The temperature difference of the components is only ~16 K, with the more massive component as the slightly cooler one. The inclination is 73.7±0.1˚ so that no total eclipse was determined. A q-search was undertaken confirming the original solution. No third-light contribution or star spot was found. More information is given in this preliminary report.
	Astrometric Analysis of 4 Double Star Systems **Jack Cleveland**, Kristen Thompson (Davidson College)	We report astrometric observations of double stars from the Washington Double Star Catalog whose physical nature was not previously known. The Las Cumbres Observatory global telescope network was used for observations of four different double stars. Of these targets, two received full astrometric analysis of 15 images. These measurements, along with information from online databases such as Gaia Data Release 3, were used to classify both systems. This study publishes new measurements of separation and position angle, and estimations of stellar masses and periods for these pairs. The two remaining candidates had complications in their test images that did not allow for full observation. Information from the databases was used to classify these systems in the absence of new measurements.
	Kinematic Distance to NGC 6309 **Scott C. Scharlach** (PARI/Tufts University/Pomona College), and Colton G. Morgan (PARI/University of Chicago)	See 1:45 Abstract in **Oral Session II**

	Oral Session I Short Talks	Abstract
11:00 a.m.	***Exploring the Deep, High-Cadence Sky with the Argus Optical Array*** Nicholas Law, Hank Corbett, Alan Vasquez, Nathan Galliher, Ramses Gonzalez, Lawrence Machia (UNC-Chapel Hill)	The Argus Optical Array will be the first all-sky, arcsecond-resolution, 5-m class telescope. The 55 GPix Array, currently being prototyped, will consist of 900 telescopes with 61 MPix very-low-noise CMOS detectors enabling sub-second cadences. Argus will observe every part of the northern sky for 6-12 hours per night, achieving a simultaneously high-cadence and deep-sky survey. The array will build a million-epoch movie of the sky, reaching dark-sky depths of mg=19.6 each minute and mg=23.6 each week over 47% of the entire sky, enabling the most- sensitive-yet searches for high-speed transients, gravitational-wave counterparts, exoplanet microlensing events, and a host of other phenomena. Argus Pathfinder, the 38-telescope prototype system, will deploy to PARI in the Pisgah National Forest, NC this year. We will present the new Argus Array design and discuss how NC astronomers can get involved with the Array.
11:15 a.m.	***The Terabit Sky: Implementation and Status of the Argus Array Hierarchical Data Processing System*** **Hank Corbett**, Nicholas Law, Alan Vasquez, Nathan Galliher, Ramses Gonzalez, Lawrence Machia, Jonathan Carney, Glenn Walters (UNC-Chapel Hill)	The Argus Optical Array is a synoptic survey observatory, currently in development, that will have a total collecting area equivalent to a 5-meter monolithic telescope and an all-sky field of view, multiplexed from 900 commercial off-the-shelf telescopes. The Array will observe 7916 sq. deg every second during high-speed operations (mg≤16.1) and every 60 seconds at base cadence (mg≤19.6), producing 4.3 PB and 145 TB respectively of data per night with its 55-gigapixel mosaic of cameras. The Argus Array Hierarchical Data Processing System (Argus-HDPS) is the instrument control and analysis pipeline for the Argus Array project, able to create fully-reduced data products in real time. We pair sub-arrays of cameras with colocated compute nodes, responsible for distilling the raw 11 Tbps data rate into transient alerts, full-resolution image segments around selected targets at 30-second cadence, and full-resolution coadds of the entire field of view at 15+-min cadences. Production of long-term light curves and transient discovery in deep coadds out to 5-day cadence (mg≤24.0) will be scheduled for daytime operations. In this talk, I will describe the data reduction strategy for the Argus Optical Array and demonstrate image segmentation, coaddition, and difference image analysis using the GPU-enabled Argus-HDPS pipelines one early data from the Argus Array Technology Demonstrator.
11:30 a.m.	***A Photometric Search for Atmospheres Around Kepler/K2 Exoplanets Through Comparison With TESS Data*** **Ian Branigan**, Jon Bennett (NC School of Science and Mathematics)	Transiting exoplanets possessing atmospheres can exhibit a wavelength-dependent transit depth, which can be used to detect and analyze these atmospheres. This study aims to take advantage of the difference in wavelength bands observed by the Kepler and TESS observatories to search for differences between the corresponding transit depths among a sample of known exoplanets. We observed these differences for 13 exoplanets, and in this presentation we'll focus on 3 of these exoplanets which demonstrate the promise of this method for identifying and confirming atmospheres without requiring detailed spectroscopic observations.
11:45 a.m.	***Interstellar Meteoroids*** **Amanda Peake** (Wake Forest University), Peter Brown (University of Western Ontario), William Cooke (NASA Meteoroid Environment Office), PARI	Interstellar meteoroids are meteoroids that originate from outside of our solar system. They are classified by orbits that are unbound around our Sun, with orbital eccentricities, e, >1. This project attempted to identify and classify interstellar meteoroids from a data set of all meteor events from 2017-2022 captured by EMCCD cameras affiliated with the Meteor Group of University of Western Onterio and the Meteoroid Environment Office at NASA. From approximately 100,000 events, 4,500 were identified as potential interstellar candidates. After manual trajectory analysis, 2 events were identified that fit interstellar characteristics. In the next stage of this project, manual reductions of the events will be performed to achieve accurate error measurements and to confirm these results.
12:00 p.m.	***NCIDA Update*** **Dan Caton** (Appalachian State University)	

	Oral Session II Short Talks	Abstract
1:15 p.m.	***Computational Topology detects and Classifies Solar Phenomena*** **Aidan Lytle**, Alicia Aarnio, Neil Pritchard, Thomas Weighill (UNCG)	Developing automated solar weather detection and classification is of paramount importance in an increasingly digital world. We develop and demonstrate a novel machine vision method using topological data analysis, which successfully detects and classifies solar phenomena. This method is extremely computationally inexpensive compared to other methods used, such as deep learning and multilayer convolutional neural network methods. This comes with only a slight reduction in accuracy, and better represents the underlying phenomena.
1:30 p.m.	***Improving the Orbit of the Double-Lined Binary system 2 Lac.*** **Holly Buroughs**, A.S. Miroshnichenko, S. Danford, A. Aarnio (UNCG)	Many bright binary systems were observed on photographic plates during the 20th century. However, their orbits were determined with moderate accuracy and needed verification with modern digital spectroscopy. Improved orbital parameters allow more precise measurements of the stellar masses, which can only be directly measured in Binaries. The bright (visual magnitude 4.5) binary double-lined binary system 2 Lac with an orbital period of 2.61 days was previously observed in 1908, 1939, and 1974. The orbit and parameters of both stars were derived with large uncertainty. We obtained 45 spectra of 2 Lac in 2020-2022 at the Three College Observatory in a wavelength range of 3800 and 7900 Å with a spectral resolving power of 12,000 and measured positions of the strongest lines (hydrogen, helium, silicon, iron). Here we report our results and improvements to the knowledge about this binary system.
1:45 p.m.	***Kinematic Distance to NGC 6309*** **Scott C. Scharlach** (PARI/Tufts University/Pomona College), and Colton G. Morgan (PARI/University of Chicago)	We present an updated distance measurement to the planetary nebula NGC 6309 (Box Nebula) using the Kinematic Distance Method (KDM). We find the distance to be 4.1+0.29/-0.38 kpc. The updated approach for calculating the distance to planetary nebulae (PNe) allows a multitude of other intrinsic features of PNe to be determined, such as radius, age, absolute magnitude, and luminosity.
2:00 P.m.	***Letting the Universe Erupt into the Classroom*** **Enrique Gómez** (Western Carolina University)	The introduction of the robotic telescopes into the classroom offers the opportunity for students in K-12 through college to engage with introductory astronomy content in new ways. One such way is when an optical transient event such as an exoplanet transit, a nova, a supernova or cataclysmic variable eruption occurs in the middle of the term. In a class using robotic telescopes, students can be invited to apply their observing skills to collect data for such an event as part of their learning experience. We also report on how we incorporate students into the monitoring of unexpected transient events in the middle of the semester such as Nova Cassiopeia 2021, SN2021aefx and an initially suspected nova, AT2021afpi, that later was recognized as likely unknown dwarf nova in outburst.
2:15 p.m.	***Robeson Planetarium Update*** **Ken Brandt** (Public Schools of Robeson County Planetarium/USC Beaufort)	The Robeson Planetarium has been a journey for the last six years, since the flooding of Matthew. This presentation is really a song of hope, encouragement, and resilience. See our plans for the rebuild, and the exciting developments just days away!
2:40 p.m.	**Regional Teaching Exchange**	*Open Discussion - share your ideas for the astronomy classroom.*

Rebekah Dawson is the Penn State Astronomy & Astrophysics Shaffer Career Development Associate Professor of and Associate Head for the Graduate Program. She received her BA in Astrophysics from Wellesley College, PhD in Astronomy & Astrophysics from Harvard University, and was a Miller Postdoctoral Fellow at UC Berkeley. Her research interests include extra-solar planets, debris disks, dynamics of planetary and satellite systems, the Kuiper Belt, planet formation, and signal processing. Her work was recently recognized by the American Astronomical Society Helen B. Warner Prize (2021) and American Astronomical Society Division of Planetary Science Harold C. Urey Prize (2020).

Meeting Website: https://www.gtcc.edu/community-engagement/cline-observatory/special-lectures-and-events/ncam.php