Online Proceedings

Poster Session 1

MGH 241, Easel 152

11:00 AM to 1:00 PM

Targeting the Niacin Receptor HCA2 as a Host-Directed Therapeutic for Mycobacterium Tuberculosis Infection

Nihar Mahajan, Junior, Biochemistry
Mentor: Thomas Hawn, Medicine
Mentor: Jason Simmons, Medicine

Mycobacterium tuberculosis (Mtb) is a widespread disease affecting about 33% of the human population around the world. Treatment of tuberculosis (TB) is hampered by a need for lengthy, multi-drug regimens and drug resistance requiring development of novel therapeutics. Our laboratory is interested in harnessing the host immune response to enhance Mtb killing within the macrophage. Within the host, Mtb is found within lipid-laden macrophages where lipid droplets are hypothesized to both provide nutrients as well as sequester Mtb from intracellular killing mechanisms. Hydroxycarboxylic acid receptor 2 (HCA2) is a G-protein coupled receptor (GPCR) that maintains lipid droplets after activation by its ligands nicotinic acid (NA) and beta-hydroxybutyrate (BHB). In these studies, we assess NA, BHB, and the structurally related small molecules nicotinamide (NAM), sodium butyrate (NaB) and phenylbutyrate (PBA) modulate HCA2 signaling. We have transiently transfected CHO-K1 cells with plasmids encoding human HCA2 and aequorin, the latter which oxidizes coelenterazine in a reaction that generates a luminescent signal. The effective concentration (EC50) of each small molecule as a ligand for HCA2 can then be calculated from the luminescence curve. Preliminary work in our lab suggests that PBA inhibits Mtb replication within the host macrophage, but several mechanisms are likely involved. We hypothesize that NaB, PBA, and NAM will also modulate HCA2 activity given their similar structures to NA and BHB. Future studies will also interrogate whether this panel of small molecules impacts HCA2 gene expression, lipid droplet formation and Mtb replication in macrophages.

Poster Session 1

Commons East, Easel 80

11:00 AM to 1:00 PM

Next Generation Manastash Ridge Observatory Control Systems: Bifrost and Evora

Douglas Robert (Doug) Branton, Senior, Physics: Comprehensive Physics, Astronomy
UW Honors Program
Tristan J (Tristan) Hillis, Fifth Year,
Mentor: Sarah Tuttle, Astronomy
Mentor: Jason Lozo, Astronomy

New hardware at the University of Washington's resident astronomical research facility, Manastash Ridge Observatory, allows the opportunity to implement new software control systems. We've built these control systems, Bifrost and Evora, in the programming language Python to provide an intuitive well-documented replacement for former limited software. Bifrost is the telescope control computer, handling all aspects of physical telescope motion. The new auto-guider provides precise corrections to telescope motion and is controlled by the observer through Bifrost. Bifrost also provides the observer with a robust toolset such as logging, real-time airmass readout, and target trajectory plots. Additionally, scientific imaging is performed by the new Andor Camera. Evora interfaces with Andor, enabling a modern feature set of camera controls beyond simple exposures and temperature control. More advanced features include series imaging, camera scripting, and low level photo analysis. Together, Bifrost and Evora provide a feature-complete observing experience for the end-user. Most importantly, they provide a strong base for future projects through documentation and extensible design to enable the development of new software such as for the upcoming spectrograph.

Poster Session 1

Commons East, Easel 79

11:00 AM to 1:00 PM

Manastash Ridge Observatory Auto-Guider Control System

Magdalyn Abigael (Maggie) Paige, Sophomore, Pre-Major
Courtney Nicole Johnson, Senior, Physics: Applied Physics, Astronomy
Mentor: Sarah Tuttle, Astronomy
Mentor: Jason Lozo, Astronomy

As a part of the Astronomy Undergraduate Engineering Group, we have further developed the software responsible

for controlling the Manastash Ridge Observatory's (MRO) auto-guiding system. Using the programming language Python, we have evolved the guider's graphical user interface (GUI) that will be used to control the auto-guiding system so as to make it capable of communicating with the telescope to make adjustments, such as tracking, focus, and guider rotation. The guider software establishes basic functionality allowing us to take images, locate stars in them, and log the associated data, as well as use the stars in the field of view to dynamically correct tracking and focus errors. Essentially, we have reconciled two partially developed systems—the GUI and the guider software—to use the GUI as an accessible and streamlined control system for the guider. This system will provide users with an easy means of regulating data collection.

POSTER SESSION 2

Balcony, Easel 91

1:00 PM to 2:30 PM

Exploring the Relationship between Types of College Residences and Trends in Marijuana Consumption

Manali Sunil (Manali) Kher, Senior, Psychology
Annmarie Seulbi Yi, Senior, Psychology
Hyunah Lim, Senior, Psychology
Mentor: Mary Larimer, Psychiatry & Behavioral Sciences
Mentor: Jason Kilmer, Psychiatry & Behavioral Sciences

Over the past few years, marijuana use has been on the rise in colleges, with 5.7% of college students saying that they smoke marijuana daily or almost daily according to a study done by the University of Michigan. Although this shows that daily marijuana use has increased, it does not explore the relationship between living situations and how much marijuana college students smoke. The purpose of this exploratory study is to examine living situations, specifically college students who live in fraternity/sorority housing, in residence halls, or in off-campus apartments/townhouses, and marijuana use among college students during a year. It is hypothesized that students who live in fraternity/sorority houses will have smoked more marijuana than students who live in apartments/townhouses and residence halls, respectively. The sample is comprised of three groups who attend four-year universities: 25 participants were Greek members, 634 participants lived in off-campus housing, and 121 participants lived in residence halls. Study participants were Washington State emerging adults (18-25) who completed the current measures as part of a larger assessment in 2016. A chi-squared test was conducted and it was seen that 44% of the Greek members, 15.77% of off-campus housing members, and 4.96% of residence hall members smoked marijuana at least 2-3 times per month. Preliminary findings support the hypothesis, showing that Greek members smoked the most out of all three groups and further analysis will be done to show whether these findings are significant.

SESSION 2M

FUNDAMENTAL IMMUNE MECHANISMS

Session Moderator: Alanna Ruddell, Comparative Medicine

MGH 287

3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

Stability of Remodeling-Associated and Immunomodulatory Gene Expression by Primary Bronchial Epithelial Cells from Asthmatic and Healthy Children over Increasing Cell Passage

Maryam Farrukh (Maryam) Naushab, Senior, Biology (Molecular, Cellular & Developmental)
Mentor: Jason Debley, Pediatrics

Studies using primary airway epithelial cells from asthmatic and healthy donors have reported differences in gene expression of a variety of genes between cells from asthmatic and healthy donors. However, few studies have investigated the stability of gene expression by primary cells with increasing cell passage number, or how viral infection might affect the stability of gene expression with increasing cell passage number. This research investigated: 1) whether expression by primary bronchial epithelial cells (BEC) of genes IFIH1, which codes for a viral sensor protein with an important role in the innate immune response, and TGFβ2, a pro-remodeling cytokine, from asthmatic and healthy children, is stable with increasing cell passage number, and 2) if BEC infection with respiratory syncytial virus (RSV) alters the stability of IFIH1 and TGFβ2 expression with increasing cell passage number. To answer these questions, we differentiated passage 1, 2, 3, 4, and 5 BECs from asthmatic and healthy children at an air-liquid interface for 3 weeks. RNA was then harvested from BECs and RT-PCR was performed for TGFβ2 and IFIH1. To assess the expression stability across increasing cell passage number for each gene, we compared expression at passages 2-5 to expression at passage 1. Preliminary data collected shows that expression of TGFβ2 and IFIH1 from asthmatic and healthy children was stable with no significant differences between passages 1, 2 and 3. However, expression at cell passages 4 and 5 was significantly greater and more variable than by passage 1 BECs. We anticipate gene expression to be even more variable for RSV-infected passage 4 and 5 BECs. These observations illustrate the importance of using BECs from passage ≤ 3 when comparing gene expression between asthmatic and healthy primary BECs, and of characterizing the expression pattern across increasing cell passage number for each gene studied.

POSTER SESSION 3

Commons East, Easel 49

2:30 PM to 4:00 PM

APO Dual Instrument Spectrograph

Taylor Rene (Taylor) Perko, Junior, Aeronautics & Astronautics
Mentor: Jason Lozo, Astronomy
Mentor: Oliver Fraser, Astronomy

As part of an ongoing effort to maintain the current high standard of astronomical instrumentation at the Apache Point Observatory in New Mexico, the Astronomy Undergraduate Engineering Group is pursuing a series of instrument and facility upgrades. One such upgrade includes new optical slits for the Dual Instrument Spectrograph (DIS). This instrument is a "variable slit" aperture that has a series of fixed width slits that mount into a rotating wheel. With DIS, the user can rapidly switch the slits as needed for their observing program, which is a powerful feature of the spectrograph. DIS is used in long slit spectroscopy from observing the rotation curves of galaxies to the expansion of optically thin nebulae. The slits being replaced were machined from stainless steel, giving undesirable width and edge uniformity. To eliminate these issues, we have constructed the new series of DIS slits using microelectromechanical systems (MEMS) processing at the Washington Nanofabrication Facility in order to get slit widths with precision on a sub-micron scale and edge uniformity less than 1%. The MEMS processing involved laser lithography, wet etching silicon wafers with KOH, and thin film deposition of aluminum. Full characterization of the finished product was done with microscopy and Fraunhofer laser diffraction. This fabrication process will provide unprecedented spectroscopic accuracy, enabling astronomers from dozens of member institutions to gather data faster and more accurately than ever. The MEMS processing manufacturing technique also has the potential to be used at other sites as it allows a way to make a wide variety of slit configurations more efficiently and at a lower cost than ever before.

POSTER SESSION 3

Commons East, Easel 48

2:30 PM to 4:00 PM

PanOptes: Low-Budget Survey Astronomy

Courtney Nicole Johnson, Senior, Physics: Applied Physics, Astronomy
Mentor: Jason Lozo, Astronomy

PanOptes is a low-cost, wide-field robotic survey telescope that uses two DSLR camera bodies to take images. These camera bodies house CMOS chips, which are already used in astronomy today. The use of off-the-shelf hardware keeps the cost down while still taking valuable science data. The ultimate goal of the project is to ultimately track the brightness of stars in a field in order to find transiting exoplanets, and the current capacity of the project is responding to gamma ray bursts. A major part of this project will be constructing a data pipeline that is capable of reducing several gigabytes of data per night of data, and extracting brightness values for each stellar body in the image. From this, brightness values over time will be tracked, allowing for planet transits as well as variable objects to be monitored. This low budget, high value student driven instrument will be tied into a wider network of small robotic telescopes to further increase the scientific value of the project.

POSTER SESSION 3

Commons East, Easel 50

2:30 PM to 4:00 PM

MRO Spectrograph and Calibration System

Jane Reilly Mc Nicoll, Senior, Astronomy, Physics: Comprehensive Physics
Jimmy Ragan, Senior, Physics: Comprehensive Physics, Astronomy, Aeronautics & Astronautics
Mary Gates Scholar
Mentor: Jason Lozo, Astronomy
Mentor: Sarah Tuttle, Astronomy

The University of Washington's Manastash Ridge Observatory, a facility utilized by undergraduates to train students in current observational astronomy methods, is being upgraded with a new spectrograph system. Our student-led upgrade is a redesign of all aspects of the existing spectrograph and calibration system. We have purchased a new camera and redesigned a pickoff system that will allow the telescope to switch between spectroscopy and direct imaging. The necessary focal reducing and transfer optics are simple, off-the-shelf items, while the pickoff mirror and slit viewer optics will be made by us. The new spectrograph will use fiber optic cables to take light from multiple locations in the image and extract several spectra simultaneously. This will allow for the spectra of the target, background sky, and a calibration source, which consists of mercury and neon lamps, to be directly compared. Our new method simplifies the process of data reduction and reduces any systematic errors that may occur from one exposure to the next. The light from the dedicated calibration fiber will provide a consistent reference with known emission lines from one exposure to the next, and provide the baseline needed to scale wavelength dispersion per pixel. Once completed, the spectrograph will allow University of Washington students to perform spectroscopy during observation, which is relevant to both undergraduate astronomy course work and modern astronomy research.