The Department of Physics and Astronomy
Announces a Spring 2023 Artist in Residence program in Creative Arts

Opportunity:
The Department of Physics and Astronomy invites proposals for Artist-in-Residence projects that respond to Physics and Astronomy research from creative visual arts, literary, film, performance, music composition, and design perspectives. Creative artist residents are expected to embed themselves in the research lab/group to envision and produce a response that connects to the scientific research (participating research group descriptions included below.) Collaborative applications are welcome. Preference will be given to those who have not previously participated. Selected artists will receive $500 at the end of the program. Funding for reasonable material, presentation, and display expenses will also be provided.

Open to: Undergraduate and graduate Studio Arts, Music, Theatre Arts, Film Studies, Architecture, and English majors and minors.

Expectations:
Selected creative artists are expected to spend time each week with the research group, and create a unique work, body of work, composition, or set of compositions in response that is presented at an exhibition/performance at the end of the spring term.

About the participating Physics and Astronomy research groups:
There are a number of different Physics and Astronomy groups that are interested in participating in this program. Please see the attached descriptions provided by the Physics and Astronomy faculty.

Information sessions:
Potential applicants interested in learning more about participating Physics and Astronomy research groups should plan to attend an information session to meet sponsoring researchers for a brief tour of the labs.
Dates – Wednesday, October 12, 4:00-5:00 pm; 319 Allen Hall and
Thursday, October 13, 3:00-4:00 pm; 319 Allen Hall

Proposal requirements:
- Students should be in good academic standing and have declared a disciplinary major or minor in English, Music, Studio Arts, Film Studies, Theatre Arts, and Architecture.
- Application file including contact info, GPA, artistic department faculty letter, current resume, unofficial transcript
- The artistic department faculty letter must confirm that the faculty advisor has reviewed and supports the merit and feasibility of the artist's proposed work. The creative artist and their advisor should specify how the advisor will support the creative artist. Examples include a mutual commitment to regular meetings or registering for independent study with the faculty member.
- A two-page proposal for the creative plan that connects the creative work to the research groups
- A one-page budget estimating material and presentation expenses (wood, etching plates, paper, framing, pedestals, performers, recording equipment, equipment rental, etc.).
- Work samples, including 2-3 written works, 3-5 JPEG images of visual work (with brief image description of title, media, dimensions, year of completion), 2-3 video samples, or two 5-10 minute MP3 composition/performance samples. Total file size should not exceed 20 MB. Alternatively large files may be posted on a third party site with a link provided.

Deadline to apply: Monday, November 7. Application materials or questions should be emailed to Michele Slogan (slogan@pitt.edu). For more information on the program and descriptions of the artists go to http://www.physicsandastronomy.pitt.edu/artist-residence-program.

Carles Badenes, Astro/Cosmo
Most stars are not alone. They live and die in close proximity to other stars - in astronomy, we refer to these 'stellar marriages' as 'multiple star systems'. The iconic image of Luke Skywalker against the twin setting suns of Tatooine from the Star Wars movie is a depiction of one such system. Professor Badenes and his group search through large amounts of data gathered by modern astronomical surveys like the Sloan Digital Sky Survey (SDSS) to identify multiple stellar systems, study the frequency of stellar companions as a function of the properties of the stars, and find rare and interesting systems with exotic companions like neutron stars and black holes.

Rachel Bezanson, Astro/Cosmo
I am an observational astronomer studying the formation and evolution of galaxies through cosmic time. My work uses some of the largest telescopes in the world (the Keck telescopes in Hawaii, the Gemini telescopes in Hawaii and Chile, the MMT in Arizona, and the Very Large Telescopes/VLT in Chile, the ALMA telescope in Chile) and in space (the Hubble Space Telescope and the James Webb Space Telescope) to study the detailed properties of galaxies in the distant - and therefore early - Universe. This year I am leading a large treasury program in the first year of observations with JWST to detect light and study the properties of the earliest, and most distant, galaxies in the Universe, thus expanding our cosmic horizon. My work aims at characterizing how galaxies form, how they shut off their star-formation and transform, how the stellar motions trace the galaxies' evolving gravitational potential wells, and the importance of interactions with neighboring galaxies.

Joe Boudreau, Particle
Our group studies the highest energy collisions ever created in the laboratory. We work at the most complicated machine ever constructed, the LHC and its associated detector ATLAS. The object of our study:
* the heaviest elementary particle known to exist (the top quark).
* the second heaviest particle and the most exotic form of matter known to exist, the most recently discovered particle, the Higgs boson.

We sift through one of the world's largest data samples in order to carry out these studies. There are three professors in our group, and also three postdocs, plus graduate students and undergraduate students. At the moment, the three postdocs live and work in Geneva Switzerland. Among the many tasks that we carry out is the production of high quality 3D images of the most important collisions in the dataset. The 3D event display software has a scientific purpose but also calls upon our aesthetic sensibilities as well, which may possibly make this an ideal collaborative project for an artist in residence.

Some of the images are collected here:
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/EventDisplayPublicResults

Ayres Freitas, Particle
There is more to every single fundamental particle interaction than meets the eye. Even in a very ordinary process, such as two electrons repelling each other, many other particles zoom back and forth between the electrons for a fleeting moment. These particles may be much heavier than the electrons themselves, and they are not seen in an experimental detector, but they affect the outcome of what is observed. In this way it was possible to predict many properties of the elusive Higgs boson before it was finally directly discovered in 2012. Freitas is involved in theoretical calculations of these subtle quantum effects that could allow us to learn something about more exotic new particles that have not (yet) been detected by any experiment. Such particles are expected to exist to explain the nature of dark matter and the absence of antimatter in the universe.

Michael Hatridge, Condensed Matter
Our research focuses on the open challenge of building a quantum computer. Such a machine will harness the complexity and coherence of quantum bits to address challenges in computation and the simulation of complex quantum systems. Practically, we currently build systems which are composed of a few quantum bits, and working to develop the tools for larger modules. In our lab we work on a daily basis with the 'paradoxes' and thought-experiments of quantum theory such as Shroedinger's cat, Zeno's paradox, quantum jumps, and spooky action at a distance, realizing them in experiments and using them as engineering tools for our quantum

machines. Key technologies for our work include precision analog microwave electronics, cryogenics, and nano-fabrication of superconducting circuits. Our lab is located in 100 OEH, and has a glass front wall, feel free to wander by and see us at work.

Jeremy Levy, Condensed Matter
"Nano Sketches"
Jeremy Levy's laboratory works with a material that can be "sketched" with a tiny (nanometer-scale) tip. Our "canvas" is an electrical insulator but when this tip moves across it can create conducting lines that are only a few atomic spacings wide. The proposed idea would involve creating art using the world's smallest Etch-a-Sketch. The artist would be able to draw sketches on our nano-canvases in our laboratory, and work with scientists to forge a connection between science and art.

Andrew Mugler, Biophysics
Cells are living machines. They process information, make decisions, and take action. Cells sense their environment with a precision that no engineered device could beat. Groups of cells perform collective tasks that no cell can perform alone. The Mugler Group uses theoretical physics to investigate cell sensing, signaling, and communication. This helps further our our understanding of biological mechanisms and combat disease.

Jeffrey Newman, Astro/Cosmo
I do research on cosmology - the study of the Universe as a whole, its history and contents - as well as the formation of galaxies and their development over time. I work primarily with large statistical, "survey" datasets, generally assembled by large teams of astrophysicists. My current areas of focus include:

• The DESI (Dark Energy Spectroscopic Instrument) project, which is using a new instrument on the Mayall Telescope in Arizona to map out the locations of roughly 40 million galaxies, studying the hidden web of dark matter and how the universe has grown over time as well as the galaxies themselves.

• Preparations for the Vera C. Rubin Observatory, which is now under construction in Chile. The Rubin Observatory will survey the entire visible sky every few nights for 10 years, revealing what changes from night to night (e.g., asteroids that might hit the Earth, which move across the sky) while simultaneously providing rich information on billions of galaxies, allowing precision studies of dark energy.

• Studies of the Milky Way galaxy: My students and I have studied the properties of the Milky Way galaxy we inhabit and how it compares to other galaxies in many ways (including its size and color).

Vittorio Paolone, Particle
Particle physics is the study of the fundamental constituents of matter and how they interact. One of these constituents are a set of particles called neutrinos. Presently there are three known types of neutrinos: electron neutrino, muon neutrino, and tau neutrino. A majority of the neutrinos around us were born around 15 billion years ago, soon after the birth of the universe. Neutrinos have incredibly small masses and in general don't like to interact with matter. The neutrino density in the universe is estimated to be about 330 million neutrinos per cubic meter and a neutrino could pass through a light years' worth of lead and still not interact. Therefore at any second several trillion neutrinos passed through a finger in your hand. My research focuses on the study of neutrino properties through their flavor (type) mixing (oscillations) and interactions with matter.

Hrvoje Petek, Condensed Matter
Light propagates at a velocity of 3x10^8 m/s, which takes it only 1.3 seconds to reach the Moon, but in our research, we have femtosecond (10^-15 s) temporal resolution, which enables us to image light on 10 nm (10^-8 m) spatial scales. In our ultrafast microscopy experiments, we can take movies of light propagating and interacting with itself or other materials. In particular, we are interested in creating plasmonic vortices, where light is structured so that it appears to rotate in place. At the moment, we are considering how to make arrays of light vortices undergoing pirouetting motion, in concert, on silver surfaces.

Evan Schneider, Astro/Cosmo
We study how galaxies emerged from the homogeneous soup of the early Universe with the array of shapes and sizes that we see today. We are particularly interested in how galaxies process gas — that is, how a "typical" galaxy like our Milky Way converts gas into stars, how supernova explosions at the end of those stars' lives can

expel the remaining gas from a galaxy, and how this cycle affects the structure of galaxies over billions of years. Galaxy evolution proceeds over billions of years, so any individual observation of a galaxy is a snapshot in time. With the help of numerical simulations, we computational astrophysicists write code to create computer models of galaxies that evolve over time in accordance with the physical laws of gravity, fluid dynamics, and electromagnetism.

Michael Wood-Vasey, Astro/Cosmo
I work with exploding stars across the cosmos. We observe these "supernovae" to measure the expansion of the Universe over the past 10 billion years of its existence (3/4 of the total age of the Universe). To find and study these events we use large telescopes and modern computing and statistical approaches to try to understand the nature of the dark energy that is accelerating the expansion of our Universe.

Andrew Zentner, Astro/Cosmo
I am a theorist with research interests that lie within cosmology, defined rather broadly. I strive to maintain a close connection with observation in large part because the amount and discriminating power of observational data is expanding rapidly and will continue to expand into the next decade. My aim is to make predictions that are unique and testable in the near term and to facilitate comparisons with data that are robust and maximize the discriminating power of the data. In many cases, this leads to studies of the particular capabilities of forthcoming instruments to study any variety of phenomena, from dark energy evolution to galaxy formation processes. My interests range throughout a broad cross section of cosmology to encompass galaxy formation, the phenomenology and identification of the dark matter and dark energy, and astrophysical limits on fundamental physics.