UNIVERSITY of WASHINGTON

Undergraduate Research Symposium May 17, 2019 Mary Gates Hall

Online Proceedings

POSTER SESSION 1

Balcony, Easel 86

11:00 AM to 1:00 PM

Characterizing Hand-Made Planar Inductor Components in the Series RLC Circuit

Daniel Canseco-Chavez, Junior, Applied Physics, Calif St University San Marcos

McNair Scholar

Mentor: Stephen Tsui, Department of Physics, California State University San Marcos

In the introductory physics curriculum, students are taught induction and inductance by examining the behavior of the current-carrying coil. As electronic devices approach the nanoscale, one might ask a student how would it be possible to fit an inductor onto an electronic chip. A commercial microelectronics solution is the planar spiral inductor, which are conductive thin film patterns deposited on substrates especially used for high frequency applications. Although synthesizing a thin film is beyond the reach of most classrooms, the principles and advantages of a thin film inductor can be taught using very affordable copper tape. An instructional laboratory activity based on this design introduces students to inductors using a geometry not covered in the introductory text and also offers them insight into the solutions necessary to build devices at the micro- and nanoscale, which would especially be useful to careers in engineering and applied physics. In this work, we demonstrate the construction of macroscale planar spiral inductors using commercially available copper tape and compare their behavior to an off-the-shelf inductor

SESSION 2K

OUR COMPLEX UNIVERSE: PLANETS, STARS, BLACK HOLES, AND GALAXIES

Session Moderator: Jessica Werk, Astronomy

MGH 284

3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

Observational Astronomy in Tacoma: Analyzing Jupiter's Rotation and the Brightness Profile of Saturn's Rings

Megan Longstaff, Senior, Applied Physics, Pacific Lutheran University

Justin deMattos, Senior, Physics, Pacific Lutheran University

NASA Space Grant Scholar

Mentor: Katrina Hay, Physics, Pacific Lutheran University

Mentor: Sean O'Neill, Physics, Pacific Lutheran University

Jupiter and Saturn are our solar system's largest gas giants with some of the most popular features of any known planet: Jupiter's Great Red Spot (GRS) and Saturn's rings. Over the summer of 2018, we analyzed these characteristics at Pacific Lutheran University's W. M. Keck Observatory. Closer to the Earth, Jupiter's atmosphere is subject to differential rotation in which the atmosphere of the planet rotate at different speeds. We use feature tracking and 2D to 3D mapping techniques to observationally determine the angular rotation of the GRS and compare it to the expected rotation of 11.5 km/s determined by the magnetosphere. Through our analysis we observe the movement of the GRS over multiple nights and determine the average speed to be around 10.97 km/s, a 4.60% difference from the expected value. Further beyond, Saturn's rings are composed of particles of ice and dust that are thought to be remnants of comets, asteroids, or moons that collided in orbit around the planet. Since these rings are not single structures, their particles feature non-uniform spacing. The light intensity of the rings increase as you approach the B ring from either direction (with the exceptions of the Cassini Division, Encke, and Keeler gaps). Our research focused on determining the spatial variation of these intensities as observed from our land-based observatory and comparing this data to Hubble Space Telescope data quantifying atmospheric scattering in Tacoma.

SESSION 2M

MCNAIR SESSION - FROM CHAOS TO ORIGAMI: ADVANCES IN MATH, PHYSICS, CHEMISTRY AND ENGINEERING

Session Moderator: Therese Mar, OMAD and Department of Environmental and Occupational Health Sciences

MGH 288

3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

Low-Frequency Charge Noise in Single Electron Device

Steven Davis, Junior, Applied Physics, Calif St University San Marcos

McNair Scholar

Mentor: Justin Perron, Department of Physics, Calif St University San Marcos

Single electron devices (SEDs) are electronic devices that can isolate individual electrons along a conducting path. SEDs have potential applications in the field of metrology [science of measurement] and quantum computation. However, the devices have issues with performance, uniformity, and stability that must be addressed before these applications can be realized. To investigate these issues with SEDs, this work focuses on low-frequency charge noise, much less than 1 Hz, called charge offset drift. Previous studies have shown that the geometry of the device impacts charge offset drift. In this talk, I will describe our efforts to extend these studies, performed at 2.5 Kelvin, to millikelvin temperatures to further our understanding of these issues.