UCLA College | Physical Sciences Physics & Astronomy

Physics and Astrophysics Special Seminar

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Why I Stopped Waiting for Someone Else to Map the Warm-hot Circumgalactic Medium

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For over half a century, observational astrophysics has been eager to successfully detect and map the most massive baryonic component of galaxies: warm-hot phase coronal gas extending into the circumgalactic medium (CGM). Despite its importance to galaxy evolution, this phase of gas is entirely unmapped in the nearby universe. Morphological characteristics, such as the presence, size, and extent of filamentary or cloud-like structures, are impossible to determine through pencil-beam absorption line studies. The evolution of galaxies relies heavily on the properties of gaseous halos, indicating an urgent need to map and measure these understudied regions. In the last decade, high-efficiency reflective coatings for UV optics have experienced transformative improvements in reflectivity per bounce and overall coating stability in the extreme UV (EUV). Detector technology sensitive to EUV wavelengths has seen steady development of MicroChannel Plate (MCP) detector technology. In parallel with these advances in UV technology, SmallSat missions with serious science objectives—which did not exist a decade ago—have emerged as a promising platform for high-impact science, an opportunity for more adventurous experiments and investigations. In this talk, I present *Aspera* (PI C. Vargas): an EUV SmallSat mission to detect and map warm-hot phase gas emission in nearby galaxies for the first time. The *Aspera* mission is designed to target the O VI emission line doublet from highly ionized oxygen, located at $\lambda\lambda$=1032, 1038 Å rest frame. *Aspera* combines a simple spectroscopic optical design using recent advances in highly-reflective EUV-coated optics with an advanced UV MCP detector to optimize throughput and sensitivity. *Aspera* will build multiple days of exposure time on each individual target to ensure spectroscopic detection of O VI emission and produce 2D morphological maps and direct measurements of physical conditions such as kinematics. The *Aspera* concept was recently selected for funding in the inaugural 2020 NASA Astrophysics Pioneers Program ($20M) in January of 2021.

Dr. Vargas is a postdoc at the University of Arizona in Professor Erika Hamden's UV instrumentation research group. He earned his Ph.D. in 2018 at New Mexico State University, where he led and contributed to large observing programs in the radio and optical to study the link between gaseous galaxy halos and star formation. He is the Principle Investigator of the recently-funded Aspera far-ultraviolet NASA space mission, and serves as a science Co-Investigator on the Hyperion ultraviolet MIDEX mission. These missions focus on mapping circumgalactic medium emission and determining the mechanisms behind star formation.