



## **How NASA's Cold Atom Laboratory has the potential to Unlock a New Era in Planetary Science Observations**

Kamal Oudrhiri, Jason Williams, Norman Lay, Robert Shotwell, Robert Thompson, and Dustin Buccino  
Caltech/Jet Propulsion Laboratory/NASA, Pasadena, United States (kamal.oudrhiri@jpl.nasa.gov)

Ultracold gases have recently emerged as a new class of quantum sensors to provide ultra-high precision measurement opportunities for Planetary Sciences. In particular, these technologies are at the heart of the next generation of atomic clocks and inertial-force sensors. Maturing these technologies to perform robustly and autonomously in space with sufficiently low SWaP for operation on free-flyers or rovers will open the door to novel gravity experiments, seismology, PNT, and enhanced Radio and Optical Links between spacecraft with terrestrial stations. In this talk, we will provide a brief overview of NASA's Cold Atom Laboratory (CAL), which was built at the Jet Propulsion Laboratory to be a flexible, multiple-user facility to enable seminal research with ultracold quantum gases in the microgravity environment of the International Space Station (ISS). Experiments currently under investigation with CAL, which has been successfully operating onboard the ISS since June 2018, will guide near-term mission concepts for varied Planetary Sciences utilizing CAL-like apparatuses in space. The CAL mission is funded by NASA's SLPS and ISS-PO. This research is carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.