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Lunar Occultation eXplorer (LOX): A New Paradigm for Nuclear Gamma-Ray Astrophysics R.S. MILLER, Johns Hopkins University Applied Physics Lab, LOX COLLABORATION — The Lunar Occultation eXplorer (LOX) will leverage the power of temporal modulation to transform our understanding of the nuclear cosmos (0.1–10 MeV) and establish the Moon as a platform for astrophysics. LOX directly challenges traditional paradigms like Compton telescopes to mitigate mission complexity, technology development, and cost constraints, while delivering sensitivity ($<10^{-7}$cm^{-2} s^{-1} MeV^{-1}), continuous all-sky monitoring, and sub-degree localization capabilities. LOX will operate from lunar orbit, using the Moon as an occulting disk to modulate astrophysical source signatures via repeated eclipses. Simplicity is a hallmark of this efficient and validated approach. LOX's lone instrument, the Big Array for Gamma-ray Energy Logging (BAGEL) is highly scalable, limited only by SWaP resources. Data analyses rely only on spacecraft ephemerides and a rigorous statistical framework rather than kinematic reconstruction, and its operational profile mimics low-resource planetary investigations. LOX is a low-risk, high-heritage implementation benefitting from decades of lunar exploration. The mission concept, validation from the Moon/Mars, and high-priority science goals will be reviewed to highlight what LOX can reveal about matter and energy lifecycles in our galaxy and beyond.

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