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**Searching for New CP-Violating Hadronic Physics via Nuclear Magnetic Quadrupole Moments** NICKOLAS PILGRAM, ARIAN JADBABAIE, AVIKAR PERIWAL, NICHOLAS HUTZLER, Caltech — The Baryon Asymmetry (BAU) of the universe, or imbalance between matter and anti-matter, is a major outstanding problem in modern physics. The Sakharov conditions propose that the BAU results from physical processes that violate Charge Parity (CP) symmetry. CP violation can manifest itself as intrinsic permanent electric dipole moments (EDMs) and magnetic quadrupole moments (MQMs), though the predicted values of these moments from the Standard Model are insufficient to explain the BAU. Therefore, new sources of CP violation beyond the Standard Model (BSM) are required and can be probed in the lepton sector with electron EDM searches or in the hadron sector with nuclear MQM searches. Heavy polar molecules are an ideal system for probing these CP violating moments due to their extremely large internal electromagnetic fields which can be aligned in the laboratory frame. We discuss and experiment to measure nuclear MQMs in deformed nuclei using heavy polar molecules with internal co-magnetometers - closely spaced opposite parity states which provide natural systematic error rejection. This MQM measurement could probe new hadronic physics at the TeV scale, with significant room for future improvements.

Nickolas Pilgram
Caltech

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