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Polyatomic Molecules for Precision Measurements[1] ARIAN JADBABAIE, NICKOLAS PILGRAM, NICHOLAS HUTZLER, Caltech — Polar molecules are a robust platform for precision measurement searches of Charge-Parity (CP) violating physics beyond the Standard Model (BSM). When aligned in the lab frame, the molecules' large, internal electromagnetic fields serve as sensitive probes for symmetry violating electromagnetic moments of fundamental particles. Recent experiments have excluded BSM CP-violating leptonic physics at TeV energy scales. By performing measurements on laser-cooled and trapped molecules, this sensitivity could be extended by orders of magnitude. However, in diatomic molecules, electronic structures amenable to optical cycling cannot provide strong systematic error rejection via full polarization and internal co-magnetometer states. In contrast, certain polyatomic molecules exhibit both electronic structures favorable to laser-cooling and co-magnetometer states via nearly-degenerate mechanical modes, making them ideal candidates for advanced BSM searches. We report progress on two precision measurement experiments using isotopologues of YbOH: a beam measurement probing hadronic CP violation via the magnetic quadrupole moment of the 173Yb nucleus, and a measurement of laser-cooled and trapped 174YbOH to probe the electron EDM to search for new physics at the PeV scale.

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