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He-Xe co-magnetometers: systematics and sensitivity to new physics[1] WILLIAM TERRANO, JONAS MEINEL, Technical University of Munich, NATASHA SACHDEVA, TIM CHUPP, University of Michigan — Precision measurements of co-located and hyper-polarized ^{3}He-^{129}Xe gases are a promising technique for searches for a wide variety of new physics that couples to nuclear spin, most of which are in principle inaccessible at accelerators. Especially important are measurements of: Lorentz-violation; CP-violation in the form of a Xe EDM; relics of high-energy symmetry breaking; and ultra-light dark matter axion scenarios. The power of such measurements stems from very high signal-to-noise ratios and long interrogation times, enabling extreme precision in the determination of the precession frequencies of the spins of the species. Unfortunately, so far such He-Xe co-magnetometers have not realized their potential due to a systematic shift between the ^{3}He and ^{129}Xe frequencies that changes by a few μHz during each measurement, and limits the ability of this technique to identify new physics. This systematic has also been a subject to notable controversies in the community. I will present careful studies where we traced the issue back to residual longitudinal magnetization of the He and Xe, which affects the precession frequency of the two spin-species differently. Reducing this effect will greatly increase the potential physics reach of He-Xe co-magnetometers.

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