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Symmetry tests and BSM searches using hyperpolarized gases

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Precision measurement of the Zeeman splitting in a two-state system is important for magnetometry, as well as the search for physics beyond the Standard Model. The most precise tests of new physics are often realized in differential experiments that compare the transition frequencies of two co-located clocks, typically radiating on their Zeeman or hyperfine transitions. The advantage of differential measurements is that they render the experiment insensitive to common systematic effects, such as uniform magnetic field fluctuations. Clock comparison experiments are used as ultra-sensitive probe
for non-magnetic spin interactions. Recent results are reported on searches for i) short-range P- and T violating interactions between nucleons and ii)
Lorentz violating signatures by monitoring the Larmor frequencies as the laboratory reference frame rotates with respect to distant stars (sidereal modulation). Finally, new experimental initiatives to search for an electric dipole moment of 129Xe (CP-violation) are discussed, which strongly benefit from the long spin-coherence times obtained, reaching $T_{2,He} > 100$ h
and $T_{2,Xe} > 8$ h in case of 3He and 129Xe, respectively.

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