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Search for new physics using a 129Xe-131Xe-Rb comagnetometer

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In a compact 129Xe-131Xe-Rb comagnetometer, polarized Rb atoms are used both to hyperpolarize Xe atoms and to serve as an in-situ magnetometer to sense the nuclear spin signals of Xe atoms. We have used this comagnetometer to search for monopole-dipole interactions at the sub-millimeter range and at the Earth range. In both searches, we measure the ratio of nuclear spin-precession frequencies between 129Xe and 131Xe, and search for a correlated change of this ratio with either the movement of an external mass or the sensor orientation in the Earth gravitational field. The null results of both experiments set new upper limits on the coupling strength of aforementioned exotic interactions.

Orateur: SHENG, Dong (USTC)