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Searching for exotic spin-dependent interactions with single electron spin quantum sensors

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Searching for new particles beyond the standard model is crucial for understanding several fundamental conundrums in physics and astrophysics. Several hypothetical particles can mediate exotic spin-dependent interactions between ordinary fermions, which enable laboratory searches via the detection of the interactions. We present a novel platform for investigating exotic spin-dependent interactions with micrometer scales. NV centers in diamond have been utilized to search for the exotic spin-dependent interactions. We first show an experiment to constrain the electron-nucleon coupling with the force range 0.1-23 micrometers(1). We also show that upper limits on the exotic dipole-dipole interactions between electrons can be established at force range from 10-900 micrometers by our method(2).

Reference
1. Xing Rong et al., Nature Communications, 9:739 (2018)
2. Xing Rong et al., arXiv:1804.07026 (2018)

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