

Towards the development of a dual species atomic magnetic gradiometer for exotic physics search

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We describe considerations and early development of an optically pumped atomic magnetometer gradiometer comprised of two different and spatially separated atomic species (e.g. Rb and K). As a gradiometer, such a device would have reduced sensitivity to uniform magnetic fields. However, it would yield non-zero signals in the instance of exotic field - spin interactions that couple differentially with the different atoms [1]. How well can we account for residual field gradients both real (magnetic) and fictitious (e.g. AC Stark shifts and gyroscopic effects)? We consider these questions and propose a design to address the concerns. We survey combinations of atoms and/or isotopes in the context of different exotic field models.

[1]D. F. Jackson Kimball, Nuclear spin content and constraints on exotic spin-dependent couplings, *New Journal of Physics*, **17**, 073008 (2015).