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Measurement of the hyperfine anomaly in short lived radioactive nuclei: progress and outlook

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The hyperfine anomaly in atomic structure is sensitive to both the composition and radial distribution of nuclear magnetisation. Although this observable has been known of and measured since the 1950's, precise measurements have been sporadic and largely limited to stable nuclei [1]. In the last few years, developments in the β-NMR technique have provided a level of precision at which magnetic moments of radioactive nuclei can make meaningful constraints on this observable [2]. However, in all but a few cases, our knowledge of atomic structure hyperfine parameters remains insufficient. At ISOLDE, we are trying to address this problem on two fronts. Firstly, where hyperfine structure parameters are sufficiently well known, ultra-high-resolution β-NMR is being applied to determine the relevant magnetic moments. Secondly, and most significantly, we are developing new apparatus to measure hyperfine parameters of short-lived nuclei with relevant precision. In parallel to our experimental efforts to provide new information on the atomic nucleus, atomic and nuclear theoretical developments are ongoing. With these developments it has become possible to interpret our experimental observations within a modern theoretical framework. In this contribution, our recent measurement of the hyperfine anomaly in potassium will be presented, along with the developments being undertaken to enable a targeted but wide-ranging investigation of this observable across the nuclear landscape.

[1] J. Persson, "Table of hyperfine anomaly in atomic systems" At. Data Nucl. Data Tables, 101589, (2023)

[2] R. Harding *et al.*, "Magnetic Moments of Short-Lived Nuclei with Part-per-Million Accuracy: Toward Novel Applications of -Detected NMR in Physics, Chemistry, and Biology" Phys. Rev. X **10**, 041061 (2021)

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