Accurate determination of the magnetic hyperfine anomaly in atomic cesium from muonic-atom experiments

G. Sanamyan, B. Roberts, and J. Ginges

School of Mathematics and Physics, The University of Queensland, Brisbane, Australia.

The finite distribution of the nuclear magnetic moment across the nucleus gives an important contribution to the hyperfine structure known as the Bohr-Weisskopf (BW) effect. We have determined this effect in atomic ^{133}Cs with an uncertainty of 0.2% in the hyperfine structure. The value for the BW effect in the cesium atom is found from historical muonic atom measurements, in combination with our muonic-atom and atomic many-body calculations.

Our result supports the validity of the nuclear single-particle model for describing the nuclear magnetization distribution in cesium. Furthermore, it differs by a very sizable 0.5% in the hyperfine structure for ^{133}Cs from the result obtained in the uniform magnetization distribution. This result is important for the testing and development of atomic theory toward the 0.1%-uncertainty-level in precision atomic searches for new physics, particularly for atomic parity violation in cesium.