Searching for physics beyond the standard model with cold, trapped atoms: The other energy frontier

Gerald Gwinner

Department of Physics & Astronomy
University of Manitoba

Atom cooling and trapping methods, together with precise laser and microwave spectroscopy, have started to make profound contributions to low-energy searches of physics beyond the Standard Model. I will briefly review the field, and then focus on our current effort to use laser-trapped francium to study atomic parity violation (APV). In francium, the heaviest alkali and with no stable isotope, the APV signal is about 18 times larger than in the analog transition in cesium, while the atomic theory required to extract the weak interaction physics from the measurement is similarly well understood. At the ISAC radioactive beam facility at TRIUMF in Vancouver, the FrPNC collaboration has established an online laser trapping facility that can confine millions of cold francium atoms at micro-Kelvin temperatures in a volume of approximately 1 cubic mm in the center of an ultra-high vacuum chamber. This is an ideal environment for precision spectroscopy. I will present our recent progress towards APV measurements.

Supported by NSERC and TRIUMF via NRC (Canada), NSF and DOE (USA).