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Prospects for New Atomic Parity Violation Experiments

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Low-energy precision tests of electro-weak physics keep playing an essential role in the search for new physics beyond the Standard Model. Atomic parity violation (APV) experiments measure the strength of highly forbidden atomic transitions induced by the exchange of Z bosons between electrons and quarks in heavy atoms. APV is sensitive to additional interactions such as leptoquarks, and provides complementary sensitivity to weak, parity-violating electron-quark couplings relative to parity-violating electron scattering. Our group is working towards a measurement in francium, the heaviest alkali, where the APV signal is about 18 times larger than in cesium. Since francium has no stable isotopes, we have established an online laser trap at the ISAC radioactive beam facility at TRIUMF that can confine millions of cold francium atoms at micro-Kelvin temperatures in a volume of approximately 1 cubic mm, an ideal environment for precision spectroscopy. I will report on our first observation of the E1-forbidden 7s–8s transition, and discuss the prospects for improved APV measurements in francium and in general.

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