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Prospects for electric-dipole-moment measurements in Radon

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A permanent electric dipole moment (EDM) of a particle or system would arise due to breaking of time-reversal (T), or equivalently charge-conjugation/parity (CP) symmetry. Over the past five decades, a number of experiments on the neutron, atoms and molecules have only set upper limits on EDMs, and the search continues, motivated in large part by the expectation that beyond Standard-Model physics CP violation is required to explain the baryon asymmetry of the universe. In addition, new techniques and access to systems in which the effects of CP violation would be greatly enhanced are driving the field forward. One example of a system that may be favorable for significant advances is radon, specifically the isotopes ^{221,223}Rn, where the combination of significant octupole collectivity and relatively closely spaced opposite parity levels would increase the nuclear Schiff moment by orders of magnitude compared to other diamagnetic atoms, i.e. ^{199}Hg. A number of technical and nuclear-structure issues must be addressed in order to assess the prospects for an experiment of significant impact. Among the technical challenges are developing an on-line EDM experiment at an isotope-production facility that will collect and make measurements on the short-lived species (half lives are $\approx$ 25 min). We have developed and tested a system for high-efficiency collection and spin-exchange polarization of noble-gas isotopes that has been tested at the TRIUMF ISAC facility (experiment S929). Nuclear-structure issues include determining the octupole collectivity as well as the spacing of opposite parity levels. A series of experiments are planned or underway at ISOLDE (IS475 and IS552), NSCL at Michigan State University (experiments 11502 and 12006) and ISAC (S929) to study the nuclear structure of isotopes in this mass region. I will report on progress on all these fronts and comment on how we learn about the basic physical parameters of CP violation from EDM measurements.