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Search for a permanent EDM with laser cooled radioactive atom

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To explore the mechanism for the generation of the matter-antimatter asymmetry in the universe, the study on fundamental symmetry violation using the trapped radioactive atoms with laser cooling techniques is being promoted. An Electric Dipole Moment (EDM) of the elementary particle is a good prove to observe the phenomena beyond the Standard Model. A finite value of EDM means the violation of the time reversal symmetry, and the CP violation under the CPT invariance. In paramagnetic atoms, an electron EDM results in an atomic EDM enhanced by the factor of the 3rd power of the charge of the nucleus due the relativistic effects. A heaviest alkali element francium (Fr), which is the radioactive atom, has the largest enhancement factor K $\sim$ 895 in atomic system. Then, we are developing a high intensity laser cooled Fr factory at Cyclotron and Radioisotope Center (CYRIC), Tohoku University to search for the EDM of Fr with the accuracy of 10-29 e cm. To overcome the current accuracy limit of the EDM, it is necessary to realize the high intensity Fr source and to reduce the systematic error due to the motional magnetic field and inhomogeneous applied field. To reduce the dominant component of the systematic errors mentioned above, we will confine the Fr atoms in the small region with the Magneto-Optical Trap (MOT) and optical lattice using the laser cooling and trapping techniques. The construction of the experimental apparatus is making progress, and the new thermal ionizer already produces the Fr of $\sim$ 10 6 ions/s with the primary beam intensity 200 nA. The extracted Fr ion beam is transported to the neutralizer, which is located 10 m downstream, and the produced neutral Fr atoms are introduced into the MOT to load the next trapping system such as the optical dipole force trap and optical lattice. The coherence time will be increased in the laser trapping system, and the present status of the experiment will be reported.