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Development of the measurement system toward the electron EDM search with laser cooled Fr atoms

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The permanent electric dipole moment (EDM) is a suitable observable to test theoretical models beyond the standard model (SM) of particle physics. We plan to search for the electron EDM by using the laser cooled francium (Fr) atoms. The features of the laser cooled Fr atoms are as follows. The Fr atom has the largest enhancement factor of the electron EDM in the alkali atoms. Although the Fr atom has no stable isotope, some isotopes have enough life time to perform the EDM search experiment. The laser cooled atoms can suppress the statistical error and some systematic errors. The laser cooled Fr factory is being constructed at Cyclotron and Radioisotope center, Tohoku University.

The high electric field application is one of the key issues to the EDM search experiment. We are now developing the electric field application system using the stable Rb atom. We employ the glass plate coated with tin-doped indium oxide as transparent electrodes in order to enable the optical access. By measuring the DC Stark shift of the Rb atoms trapped in the magneto-optical trap, the strength of the electric field applied to the laser cooled atoms was evaluated. Furthermore, toward the pilot EDM experiment using the laser cooled Rb atoms, the both electric and magnetic fields application system is also being developed. In this presentation, we will report the present status of the EDM measurement system.

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