SEARCH FOR THE ELECTRON EDM WITH LASER-COOLED FRANCIUM ATOMS

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The electric dipole moment (EDM) of the electron is a suitable observable to test the physics beyond the standard model of elementary particles. We plan to search for the electron EDM by using laser-cooled francium (Fr) atoms. Its advantages are as follows. The electron EDM enhancement factor of Fr is the largest in the alkali atoms. The laser-cooled atoms can suppress some systematic errors due to the velocity of atom. We are constructing the laser-cooled Fr factory at Cyclotron and Radioisotope Center, Tohoku University. In our experiment, Fr is produced through the nuclear fusion reaction with the oxygen beam and the gold target. Fr is transported as an ion about 10 m away from the reaction point to avoid noises and damages from radiations. Then the Fr ion is neutralized in order to be applied the laser cooling technique. A rubidium (Rb) atomic magnetometer and a high voltage application system are also being developed. The characteristics of the Rb magnetometer based on the nonlinear magneto-optical rotation effect were studied to optimize the operation conditions. We employed glass plates coated with tin-doped indium oxide as electrodes. The strength of the electric field applied to the laser-cooled atoms was evaluated by measuring the DC Stark shift of Rb atoms trapped in the magneto-optical trap. So far, the application of 40 kV was achieved without discharge. In this presentation, we will report the present status of the laser cooled Fr factory, the magnetometer and the high voltage application system.