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Experimental search for 129Xe atomic EDM with nuclear spin maser technique

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Electric dipole moment (EDM) of a particle violates P and T symmetries and serves as a definitive probe for new physics beyond the standard model of elementary particles. We plan to search for an EDM in a diamagnetic atom 129Xe, taking advantage of spin maser technique.
In a conventional spin maser the spin precession is maintained by virtue of a feedback field that is generated by a coil coupled to the spin system. The feedback field in our maser is laboratory-composed according to an optically detected spin precession signal. From our previous studies on the operation of such a maser, it turned out that the major limiting factors on the frequency precision are drifts in the solenoid current and temperatures around the 129Xe gas cell. Thus we are presently developing a temperature stabilization system which circulates heat transporting fluid in order to suppress variation of temperature down to 0.1 degree. Also, the power of the pumping laser was found to be insufficient for the 129Xe nuclear spins to be fully polarized. We have introduced a high power laser with a reduced line width, with which an improved stabilization of the maser operation is expected. In addition, gas cells equipped with transparent electrodes for application of an electric field is being prepared. We will report on results of such developments attempting improved maser frequency precision, and discuss future prospect of our 129Xe EDM search experiment.

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