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Development of ^{129}Xe and ^{131}Xe co-existing masers with external feedback for the search for Xe atomic EDM

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Due to its almost undetectablly small magnitudes predicted from the Standard Model (SM), detection of a non-zero electric dipole moment (EDM) is expected to prove the existence of new physics beyond the SM. Even so, the expected signals for an EDM are extremely small, and thus an elaborate scheme for the suppression of errors in its measurement is essential. As for the atomic EDM of Xe, which is an objective of the present work, the current upper limit of 4.1×10^{-27}ecm corresponds to a ~40 nHz accuracy under the application of a 10 kV/cm electric field. In order to improve this upper limit, we in this work propose the use of a co-existing ^{129}Xe and ^{131}Xe spin maser complex running in an external feedback scheme. The ^{129}Xe and ^{131}Xe spins, which cohabit in the same cell volume, sense the same magnetic field and thus the effects of a long-term drift in the magnetic field are cancelled out. In particular, the systematic error arising from the interactions with polarized Rb atoms is largely eliminated thanks to their very similar strengths of coupling to Rb, as opposed to the case of a ^{129}Xe-^{3}He combination. Our external feedback scheme will ease difficulties arising from the shorter relaxation time and quadrupole frequency splitting of ^{131}Xe. In this presentation, we will report on the first operation of the ^{131}Xe maser, and its stability, and discuss future perspectives for our planned Xe EDM measurement.

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