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The Storage-Ring proton EDM potential sensitivity to the axion dark matter background field

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The axion dark matter background field can induce electric dipole moment (EDM) oscillations to nuclei via its coupling to the gluon fields. The frequency of oscillations corresponds to the axion mass. The amplitude of the oscillation is at the 10^{-34} e·cm level for the standard local dark matter density, and it is proportional to the square root of its value. The storage ring EDM method is designed to probe the proton and deuteron permanent (DC) EDM at the 10^{-29} e·cm level by freezing the spin direction along the momentum direction of a longitudinally polarized beam in a storage ring. Nonetheless, it can also be sensitive to the oscillating EDM by running the experiment so that the particle $g-2$ frequency coincides with the axion oscillation frequency. It turns out that the systematic errors are easier to handle than in the frozen spin EDM method and for the higher frequency range the sensitivity can be much larger. I will explain the details of the method and its prospects.

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