

ELECTRONIC STRUCTURE OF TRIATOMIC MOLECULES FOR SEARCH OF AXIONLIKE PARTICLES

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One of the great mysteries of modern cosmology is the unknown nature of dark matter. A popular candidate for the dark matter component is the axion – the hypothetical pseudoscalar particle. Despite numerous attempts, the axion or axionlike particles have not been reliably detected.

We study axion-mediated exchange between the atomic nucleus and electrons, which can induce a permanent electric dipole moment of the whole molecule. Therefore, axion properties can be measured indirectly in the experiments, which are aiming to search for the electron electric dipole moment (eEDM) and other spatial and time-invariance violation effects.

We consider the ytterbium monohydroxide molecule (YbOH) and calculate the corresponding electronic structure parameter, which is necessary for the interpretation of experimental data. The dependence of the axionlike particle mass is studied extensively. We estimate the expected energy shift due to this interaction; it is shown that it is the same order of magnitude as eEDM contribution, so, these effects should be taken into account simultaneously.

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