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Fundamental physics and physics beyond the standard model with ultracold molecules: prospects for aluminum monofluoride (AlF). JESUS PEREZ RIOS, STEFAN TRUPPE, GERARD MEIJER, Fritz-Haber-Institut der Max-Planck-Gesellschaft — Molecular spectra contain detailed information on the interaction between nuclei and electrons in a molecule. Therefore, accurate spectra of molecules can be used to test the standard model and to constrain the available parameter space for physics beyond the standard model. At very low temperatures, T 1mK, i.e. in the realm of ultracold molecules, the translational and internal degrees of freedom of the molecule are effectively controlled. Ultracold molecules are thus ideally suited for performing high-precision spectroscopy. In particular, by measuring the energy shift between two almost degenerate vibrational states that belong to different electronic states, it is possible to extract the tightest constraint on the time variation of the electron-to-proton mass ratio, μ . Moreover, the same measurement is possible to put constraints on the existence of extra dimensions based on the Arkani-Hamed, Dimopoulos and Dvali (ADD) model. Here, we focus on aluminum monofluoride (AlF), a molecule that we are currently working on in our laboratory. Aluminum monofluoride has a high dissociation energy and a particular electronic structure, that based on our predictions, will lead to tighter constraints on μ and on the existence of extra dimensions through the ADD model.

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