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Dark matter detection through molecular excitations JESÚS PÉREZ-RíOS, School of Natural Sciences and Technology, Universidad del Turabo, Gurabo, PR00778, USA, HARIKRISHNAN RAMANI, Department of Physics, University of California, Berkeley, CA 94720, USA, EDEN FIGUEROA, Department of Physics and Astronomy, Stony Brook University, New York 11794-3800, USA, ROUVEN ESSIG, C.N. Yang Institute for Theoretical Physics, Stony Brook University, Stony Brook, New York 11794, USA — The existence of dark matter has been confirmed by astrophysical observations, however its nature remains as one of the most intriguing open questions in physics. Over the last few years, the search for dark matter particles has begun to expand to masses below the proton mass (sub-GeV dark matter). Such dark matter may have a weak interaction with Standard-Model particles, which could allow it to be detected through scattering or absorption effects in atomic and molecular systems. In particular, internal degrees of freedom in molecules offer a great scenario for sub-GeV dark matter detection due to the low energy required to excite these degrees of freedom. Here, we propose a novel platform for detecting sub-GeV dark matter by detecting the vibrational excitation caused by dark matter-nucleus scattering on a diatomic gas at low temperature and pressure. As a result, this technique is sensitive to the dark matter in the mass range of 500 keV to 1 GeV, depending on the particular choice of molecular target.

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