Nuclear-structure effects in muonic deuterium MARCIN KALINOWSKI, KRZYSZTOF PACHUCKI, Faculty of Physics, University of Warsaw, Pasteura 5, 02-093 Warsaw, Poland, VLADIMIR YEROKHIN, Center for Advanced Studies, Peter the Great St. Petersburg Polytechnic University, 195251 St. Petersburg, Russia — Muonic deuterium is a subject of intense study due to the sensitivity of its spectrum to the electromagnetic moments of the nucleus. However, nuclear-structure effects make precise theoretical description of energy levels much harder than in the case of hydrogen. Recently, we’ve completed a systematic calculation of the leading nuclear polarizability contribution to the hyperfine splitting of the 2S state in muonic deuterium. Our result disagrees with the previous calculations and differs by 5 standard deviations from the experimental value. It suggests that the spin-dependent nuclear polarizability is not well understood.

We have also calculated the electron vacuum polarization correction to the leading nuclear-structure contribution to the Lamb shift in muonic deuterium. This correction is surprisingly large and modifies the value of the deuteron-proton charge-radii square difference, which is consistent with the precise value obtained from the ordinary H-D isotope shift in the 1S-2S transition. This agreement is a strong evidence that the charge-radii values obtained from the measurements of muonic deuterium and muonic hydrogen are correct. It suggests that any occurring discrepancies with electronic systems are due to their underestimated uncertainties.

Marcin Kalinowski
Faculty of Physics, University of Warsaw, Pasteura 5, 02-093 Warsaw, Poland