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Why three-body physics do not solve the proton radius puzzle

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The possible involvement of weakly bound three-body systems in the muonic hydrogen spectroscopy experiment [1], which could resolve the current discrepancy between determinations of the proton radius, is investigated. Using variational calculations with complex coordinate rotation, it is shown that the $p\mu e$ ion, which was recently proposed as a possible candidate [2], has no resonant states in the energy region of interest. QED level shifts are included phenomenologically by including a Yukawa potential in the three-body Coulomb Hamiltonian before diagonalization. It is also shown that the $pp\mu$ molecular ion cannot play any role in the observed line.

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