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Nonlinear Tunneling and Nuclear Decay CHRISTA LABADORF, EUGENE CHAFFIN, Bob Jones University — Recent astrophysical data have indicated a possible variation of the proton-electron mass ratio $\mu = m_p/m_e$. Attributing the variation to a change in the strength of the nuclear force, we take into account nonlinear inteactions, such as those originally proposed in 1955 by Johnson and Teller, and examine the resulting change in nuclear half lives. Our Mathematica calculations show the effect of the nonlinear terms by solving the three-dimensional nonlinear Schrodinger equation in a model applied to a typical nucleus. We match the radial wavefunction and its derivative for the interior of the nucleus to the Coulomb wavefunctions on the exterior of the nucleus in a generalization of the procedure originally used by Pieronne and Marquez, 1978, but without the nonlinear interactions. The results indicate that the nonlinear interactions, in cases where the number of nodes in the radial wavefunction is poised on a change from one value to another, can cause a large change in half-life for a small change in the strength of the nuclear force.

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