



Iranian Journal of Physics Research, Vol. 22, No. 1, 2022  
DOI: 10.47176/ijpr.22.1.21166

## Spectra of the exponential potential with the supposition of minimal length

N Ramezanloo and S Miraboutalebi\*

Department of Physics, Islamic Azad University, North Tehran Branch, Tehran, Iran

E-mail: S\_miraboutalebi@iau-tnb.ac.ir

(Received 9 December 2020 ; in final form 22 July 2021)

### Abstract

In the framework of different theories of quantum gravity, such as string theory, dual special relativity, and the physics of black holes, the existence of a minimal length is proposed. It is necessary to modify and generalize the usual Heisenberg principle of uncertainty to incorporate the minimal length into the ordinary quantum mechanics. In this scenario, the momentum of the system is modified, and the Hamiltonian obtains additional terms. It is expected that the energy spectrum of any physical system is modified under the hypothesis of minimal length. In this article, these effects on the spectra of the exponential potential for the ground state are studied by applying a perturbation method. As a popular application of the exponential potential, the deuteron bound state can be explained by using this potential. Here, the modification of the energy spectrum of deuteron under the supposition of the existence of a minimal length is calculated.

**Keywords:** Schrödinger equation, exponential potential, generalized uncertainty principle, minimal length, deuteron energy spectrum

For full article, refer to the Persian section