Superselection Rule in an Inverse Square Potential

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ABSTRACT

The one-dimensional dynamics of a particle moving under an the potential $-k/q2$, $k > 0$, $q \in <$, is analysed. The classical problem is an example of a geometric system since its negative energy orbits may be regarded as free motion on a hyperbolic arc. We solve the corresponding unrenormalized quantum system showing it devoid of a discrete energy spectrum at negative energies. Besides, the 1D quantum system shows a complete separation between the right and left sides of the origin. This fact that may be explained as the action of a superselection rule. The symmetry of inversion through the origin is spontaneously broken in this system.