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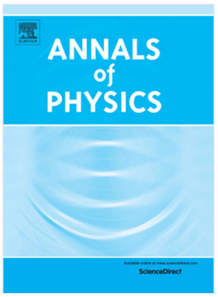

Quantum mechanics on phase space: The hydrogen atom and its Wigner functions

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Quantum Mechanics on Phase Space: the Hydrogen Atom and its Wigner Functions

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Abstract

Symplectic quantum mechanics (SQM) considers a non-commutative algebra of functions on a phase space Γ and an associated Hilbert space $\mathbb{H}_\Gamma$, to construct an unitary representation for the Galilei group. From this unitary representation the Schrödinger equation is rewritten in phase space variables and the Wigner function can be derived without the use of the Liouville-von Neumann equation. In this article the Coulomb potential in three dimensions (3D) is resolved completely by using the phase space Schrödinger equation. The Kustaanheimo-Stiefel(KS) transformation is applied and the Coulomb and harmonic oscillator potentials are connected. In this context we determine the energy levels, the amplitude of probability in phase space and correspondent Wigner quasi-distribution functions of the 3D-hydrogen atom described by Schrödinger equation in phase space.

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