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Quantum Friction in a Uniform Magnetic Field

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Abstract

The quantization of dissipative systems is of strong theoretical interest. One method consists in using explicitly time - dependent Hamiltonians. In the case where the friction is a linear function of the velocity with friction constant γ, the Hamiltonian in the canonical representation takes the form

$$\mathcal{H} = \frac{1}{2m}\left(\vec{p} + \frac{e}{c}e^{\gamma t}\vec{H}\times\vec{q}\right)^2 e^{-\gamma t} + e^{\gamma t}V(\vec{q})$$

We study a system in a magnetic field with vector potential $\vec{A} = (-\frac{1}{2}Hq_2, \frac{1}{2}Hq_1, 0)$ and scalar potential $V(\vec{q}) = \frac{1}{2}m\omega^2\,(q_1^2 + q_2^2 + q_3^2)$. We find the eigenfunctions and the eigenvalues of the corresponding Shrödinger equation.