

Effective Hamiltonians for Constrained Quantum Systems

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We consider the Schroedinger operator on a Riemannian manifold A with a potential that localizes certain states close to a submanifold C . When scaling the potential in the directions normal to C by a parameter $\varepsilon \ll 1$, the solutions concentrate in an ε -neighborhood of C . This situation occurs for example in quantum wave guides and for the motion of nuclei in electronic potential surfaces in quantum molecular dynamics. We derive an effective Schroedinger operator on the submanifold C that approximates the spectrum and the dynamics of the full operator on A up to terms of order ε^3 .