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Quantum versus classical dynamics in the optical centrifuge[1]
TSAFRIR ARMON, LAZAR FRIEDLAND, Hebrew Univ of Jerusalem — The optical centrifuge (OC) allows to control and excite molecules' rotational degree of freedom. In this work we study the interplay between classical and quantum-mechanical evolution in the OC. The analysis is based on the quantum-mechanical formalism starting from either the ground state or a thermal ensemble. Two resonant mechanisms are identified, i.e., the classical autoresonance and the quantum-mechanical ladder climbing, yielding different dynamics and rotational excitation efficiencies. The rotating-wave approximation is used to analyze the two resonant regimes in the associated dimensionless two-parameter space and calculate several characteristic values of the excited bunch such as the efficiency and spectral width. The results show good agreement between numerical simulations and theory and are relevant to existing experimental setups.

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