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Lie algebras for time evolution with applications from chaos studies to spintronics TIM G. WENDLER, MANUEL BERRONDO, TY BEUS, RYAN T. SAYER, JEAN-FRANCOIS S. VAN HUELE, Brigham Young University — We illustrate the power of Lie algebras in computing the time evolution of quantum systems with time-dependent physical parameters. By factorizing the quantum mechanical time evolution operator and using the linear independence of the Lie algebra generators, we reduce the operator equations to systems of coupled ordinary differential equations of scalar functions applicable to a variety of dynamical systems. We use the results to explore the possibility of detecting chaos in quantum nonlinear oscillators based on criteria from classical chaos studies and to follow spin currents in time-dependent spin-orbit coupled media.

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