Timescale and Regime Separations in Quantum Dynamics

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Quantum physics has many timescales, such as mixing times, scrambling times, and coherence times. Analyzing simultaneous quantum effects can be challenging, since non-commuting generators yield inseparable composites. At comparable rates, mixing processes build up and begin to dominate. When timescales are far apart, however, processes may simplify at short times while yielding greater complexity at long times. I will discuss some results on timescales of certain processes, then ways in which fast dynamics can shift regimes at long times, including preserving coherence. Finally, I note some connections to distinct regimes of chaos, simplicity, or mixture.