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Computing ionization rates from periodic orbits in chaotic Rydberg atoms[1] ETHAN CUSTODIO, KEVIN MITCHELL, University of California, Merced — When placed in a magnetic field, the electron trajectories of a classical hydrogenic atom are chaotic. The classical ionization rate of such a system can be computed with brute force Monte Carlo techniques, but these computations require enormous numbers of trajectories, provide little understanding of the dynamical mechanisms involved, and must be completely rerun for any change of system parameter, no matter how small. We demonstrate an alternative technique to classical trajectory Monte Carlo computations, based on classical periodic orbit theory. In this technique, ionization rates are computed from a relatively modest number, perhaps a few thousand, of periodic orbits of the system. One only needs the orbits' periods and stability eigenvalues. A major advantage is that as system parameters are varied, one does not need to repeat the entire analysis from scratch; one can numerically continue the periodic orbits as the parameters are varied. We demonstrate the periodic orbit technique for the ionization of a hydrogen Rydberg atom in applied parallel electric and magnetic fields.

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