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Eigenvalue Spacings in the Asymmetric Infinite Square Well
TODD TIMBERLAKE, MOLLY NELSON[1], Berry College — The distribution of eigenvalue spacings is an important tool in the study of quantum chaos. Quantum systems with chaotic classical counterparts exhibit eigenvalue spacings that follow random matrix statistics, while those with integrable counterparts generally follow Poisson statistics. One-dimensional quantum wells, which are always integrable under Newtonian mechanics, are expected to display uniform eigenvalue spacings (after unfolding). We will show that the asymmetric infinite square well (an infinite square well with a step) does not fit this expectation. The spacings between eigenvalues above the step height are not uniform after unfolding, but gradually approach uniformity at higher energies. Semiclassical analysis reveals that the departure from uniformity is due to the existence of non-Newtonian periodic orbits that reflect from the step even though their energies are above the step height. The sequence of eigenvalue spacings also displays some unusual features that are related to resonances in the classical (non-Newtonian) dynamics.

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