Abstract Submitted
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Study of Particle Interactions in Quantum Systems KYA WIGGINS, Berry College — Quantum mechanical systems are characterized by their energy eigenvalues. Previous studies have shown that the distribution of spacings between adjacent energy eigenvalues is related to the dynamics in the classical version of the system. Systems with regular dynamics have eigenvalue spacings that follow the Poisson distribution, while systems with chaotic dynamics have spacings that follow the Gaussian Orthogonal Ensemble (GOE) distribution. The goal of my research was to find a very simple quantum system that exhibits a transition from Poisson to GOE statistics, even though the classical dynamics doesn't clearly change from regular to chaotic. I investigated the eigenvalue spacings in a system of 1 to 9 Dirac delta barriers placed in an infinite square well such that the ratio of the interval lengths between the barriers was irrational. I computed 1,000 energy eigenvalues of the sequence at three energy ranges: low energy (the probability that a particle is transmitted through a delta barrier is close to zero), medium energy (the transmission probability is close to one half), and high energy (the transmission probability is close to one). I then unfolded the sequence, so that the average eigenvalue spacing was one, and found the distribution of spacings. For six or more barriers the low energy sequences followed Poisson statistics, the medium energy sequences followed GOE statistics, and high energy sequences showed Gaussian statistics peaked at one. These results are interesting because this is a very simple system, but increasing the transmission probability shifts the statistics from Poisson to GOE to Gaussian.

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