Dancing with the Stars: Simulating Multi-Star Solar Systems and the Probability of Planetary Ejection

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The overall goal of this project was to accurately model the stability of a planet in various multi-star systems. Through the progression of creating a computer model of our solar system, a binary star system, and a triple star system, I was able to incorporate Newton's Laws of Motion and Universal Gravitation using the Implicit Euler Method, which is a numerical method for solving complicated problems. For my data collection, I varied the planet distance, initial planet velocity and star distance. I would let my program run until planet in the system was ejected or the time it spent orbiting its sun passed ten million years. The computing time for ten million years proved to be too long—it took approximately 24 hours to run— so I shortened it down to 150 thousand years for the binary system and 2 million years for the triple star system. I found that typically, binary star systems are more stable than triple star systems. This makes since because the binary system is much less complex. My program can be useful to astronomers looking to model real-life multi-star systems, as one can adjust the masses, distances, and velocities of each object in the system to test out the stability lifetime of planets in such systems.

Awards Won: