Modeling of Phenomena in Multiple Stellar Systems

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After a binary or triple stellar system is formed, its components follow elliptical trajectories. Due to interaction, their trajectories gradually change with characteristic time intervals ranging from decades to thousands of years, making this phenomenon difficult to observe. In 2017, while studying a suspected variable star GSC 2.2 223013015, I discovered that it belongs to a narrow class of eccentric binaries. Apart from some geometrical and physical parameters, I found a slight mismatch of secondary minima for different observational sets. It may indicate apsidal motion, which could be caused by several factors, such as the presence of a third body in the system, relativistic effects, or non-spherical shapes of the components. In such systems it is hard or even impossible to determine some of their physical parameters. I wrote software which implements unlimited in time continuous modeling of a multiple system's motion, aimed at reproducing its apsidal motion. It allows the user to visualize the motion of multiple stellar system, get radial velocity curves, O-C diagram and apsidal motion period (for close binary system components), influenced by superposition of the listed factors. In addition to traditionally-determined geometrical and physical parameters, my program allows to evaluate the rotation rate of the components in a binary system, both, isolated and as a part of a multiple system, and predict minima phases for any instant. This makes it useful in any research of eccentric binary and triple systems, including searching for circumbinary exoplanets.

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