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Cupid is Doomed: An Analysis of the Stability of the Inner Uranian Satellites

Author Block:
: Robert S. French[1], M. R. Showalter[1]
[1]*SETI Institute.*

Abstract: We have explored the stability of the inner Uranian satellites using simulations based on the most recent observational data. We find that, across a wide range of mass assumptions, the system is chaotic, resulting in the eventual crossing of orbits. Cupid and Belinda are usually the first satellites to cross orbits, and they do so on a time scale of 10^5-10^6 years. This is two orders of magnitude sooner than the first crossing times found by Duncan & Lissauer (1997, Icarus, 125, 1-12). We show that both our higher assumed masses, based on updated observational data, and the presence of Cupid in the system decrease the stability. We also show that the power law discovered by Duncan & Lissauer, with which the orbit crossing time can be predicted using multiple, shorter simulations with higher mass assumptions, is valid across a wide range of models and can be used to increase the accuracy of determining the orbital crossing time. Finally, we show that Cupid's instability is related to the inner Lindblad resonances of Belinda.
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Special Instructions: : I would prefer to speak earlier in the week.

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