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Constraining the orbit of the retrograde planet in the ν Octantis system

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More than a decade ago, several studies were published in order to investigate the nature of the periodic signal in radial velocity data for the ν Octantis binary system. The most likely explanation is the existence of a planet in a retrograde orbit with respect to the binary [1]. The ratio of the orbital periods between the potential planet and the binary is close to 5/2, so the possibility of a mean motion resonance configuration arises. Using the numerical integrator REBOUND [2], we explore the phase space through random initial conditions and assess long-term stability of the system through frequency analysis [3]. Our analysis allows us to explore all possible configurations for the planet and to identify those which can be in resonance. Through this methodology, we thus conclude that a nearly coplanar 28/-11 mean motion resonance is the most probable configuration for the planet.

[1] Ramm, D., Nelson, B., Endl, M., et al., "The conjectured S-type retrograde planet in ν Octantis: more evidence including four years of iodine-cell radial velocities", Monthly Notices of the Royal Astronomical Society, 460, 3706, 2016.
[2] Rein, Hanno e S-F Liu. "REBOUND: an open-source multi-purpose N-body code for collisional dynamics" . Astronomy & Astrophysics 537:A128, 2012.
[3] Laskar, J., "Frequency analysis for multi-dimensional systems. Global dynamics and diffusion", Physica D Nonlinear Phenomena, 67, 257, 1993.

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