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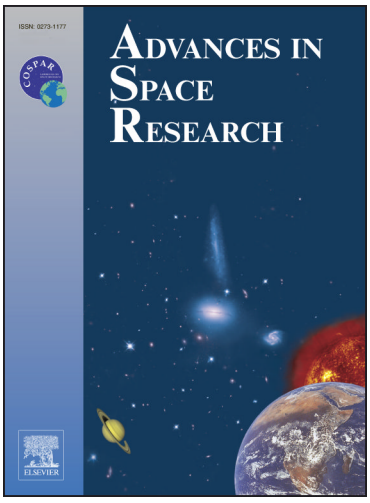

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Orbital Stability Close to Asteroid 624 Hektor using the Polyhedral Model

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Abstract. We investigate the orbital stability close to the unique L4-point Jupiter binary Trojan asteroid 624 Hektor. The gravitational potential of 624 Hektor is calculated using the polyhedron model with observational data of 2038 faces and 1021 vertexes. Previous studies have presented three different density values for 624 Hektor. The equilibrium points in the gravitational potential of 624 Hektor with different density values have been studied in detail. There are five equilibrium points in the gravitational potential of 624 Hektor no matter the density value. The positions, Jacobian, eigenvalues, topological cases, stability, as well as the Hessian matrix of the equilibrium points are investigated. For the three different density values the number, topological cases, and the stability of the equilibrium points with different density values are the same. However, the positions of the equilibrium points vary with the density value of the asteroid 624 Hektor. The outer equilibrium points move away from the asteroid's mass center when the density increases, and the inner equilibrium point moves close to the asteroid's mass center when the density increases. There exist unstable periodic orbits near the surface of 624 Hektor. We calculated an orbit near the primary's equatorial plane of this binary Trojan asteroid; the results indicate that the orbit remains stable after 28.8375 d.

Key Words: Jupiter Trojan asteroid; Binary Trojan asteroid; Orbital stability; Polyhedron model; Equilibrium points

1 Introductions

To date there are only a few Jupiter binary Trojan asteroids. These are (617) Patroclus (Mueller et al. 2010; Nesvorny et al. 2010), (624) Hektor (Kaasalainen et al. 2002), (17365) 1978 VF11 (Mann et al. 2007; Noll et al. 2014), and (29314) Eurydamas (Mann et al. 2007; Noll et al. 2014), etc. Among these Jupiter binary Trojan asteroids (617) Patroclus, (17365) 1978 VF11, and (29314) Eurydamas are located on the

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