

Evolution of the orbits of distant satellites of Uranus

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The first report on the discovery of two new Uranus satellites appeared in the late October 1997. They were found by Gladman, Nicolson, Burns, Kavelaars, Marsden, Williams, and Offutt and were preliminary designated as S/1997 U1 and S/1997 U2. At present, these new satellites are given the names Caliban and Sycorax. We took the more accurately determined elements of their uranocentric orbits from the work by Marsden (IAUC, 1998, nos. 6869,6870). These data are used to explore the evolution of the orbits of Caliban and Sycorax. Although the numerical values of the orbital elements are only tentative, they give us the possibility of introducing a well-defined model that can be used to establish the main features of the satellite orbits evolution. With the discovery of new satellites Uranus stopped to be considered a unique giant planet with no distant (or external) satellites. The mean distances of Caliban and Sycorax from Uranus 7.17 and 12.21 million kilometers are so large that the effect of Uranus's oblateness is several orders of magnitude weaker than the Sun's perturbation influence. Taking into account the small masses of the satellites (their radii are 40 km and 80 km, respectively) in view of the absence of close mutual approaches, we can use, as a first approximation of the perturbation theory, the satellite version of the restricted three-body problem (Uranus - the Sun - satellite). Analysis of evolution is done on the basis of the derived general solution of the double-averaged Hill problem. The extremal eccentricity and inclination values, as well as periods of circulation of pericenter arguments and ascending node longitude arguments, are determined. Full version of this work is published in: *Astronomy Letters*, vol. 25, no. 7, 1999, pp. 476-481.