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About the Distances of Jupiter's Satellites

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The known satellites of Jupiter do not move around the planet in arbitrary distances but they make evidently five groups. It cannot be excluded that in the distance $r \approx 52R_J$ one or more not yet discovered small satellites may exist.

Dosud známé měsíce Jupitera se nepohybují kolem planety v libovolných vzdálenostech, ale zřejmě tvoří pět skupin. Je možné, že ve vzdálenosti $r \approx 52R_J$ může existovat jeden nebo i více malých měsíců, které nebyly dosud objeveny.

До сих пор известные спутники Юпитера обращаются вокруг планеты не на любых расстояниях, но скопляются очевидно в пяти группах. Ожидается, что на рассотянии $r \approx 52R_J$ существует один или больше до сих пор не открытых спутников.

The up to now known satellites of Jupiter move around the planet not in arbitrary distances from the planet but they make evidently some groups.

Very expressive are the outermost two groups the members of which move in the distances $291-333R_J$ and $156-165R_J$.

The former group make the satellites Sinope (*J9*), Pasiphae (*J8*), Carme (*J11*) and Ananke (*J12*). All these satellites are small bodies which revolve round the planet in retrograde orbits with high inclinations and large excentricities.

To the latter group belong the satellites Elara (*J7*), Lysithea (*J10*), Himalia (*J6*) and Leda (*J13*), which circle the planet in direct orbits with high inclinations and large excentricities.

In the distances $6-27R_J$ move the four Galilean satellites. There exist probably two groups of these moons, one of which make the larger and from planet more distant Callisto (*J4*) and Ganymede (*J3*), to the other belong the smaller and nearer satellites Europa (*J2*) and Io (*J1*).

The last group of Jupiter's satellites make the innermost moons, *1979J2*, Amalthea (*J5*), *1979J1* and *1979J3*, the distances of which are $1.8-3.1R_J$. The unidentified satellite object, preliminary designed *1981J1*, is probably identical with *1979J2*.

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The mean distances $\bar{r}(R_J)$ of the individual groups of Jupiter's satellites are shown in Table 1. These mean distances may be expressed by the simple relation

$$\log \bar{r} = 0.430n ,$$

where $n = 1, 2, 3, 5, 6$. The computed mean distances r' are also shown in Tab. 1.

Table 1.

Group	Satellites	n	$\log \bar{r}$	$\log r'$
i	*1979J1, 1979J3, J5, 1979J2*	1	0·36	0·43
ii	*J1, J2*	2	0·89	0·86
iii	*J3, J4*	3	1·32	1·29
?	?	4	?	1·72
iv	*J13, J6, J10, J7*	5	2·21	2·15
v	*J12, J11, J8, J9*	6	2·50	2·58

It is evident that the agreement between $\bar{r}$ and r' seems to be very good. Moreover it is interesting that in the mean distance $r \approx 52R_J$ (corresponding to $n = 4$) no satellite is known.

The above relation is, of course, empirical only, but it cannot be excluded that in the distance $r \approx 52R_J$ one or more small Jupiter's satellites exist. The search for discovering the supposed new Jupiter's satellite (or satellites) in this distance may be interesting by the future space probes to Jupiter.

For long time it has been known that there exist orbital resonances between the inner three Galilean satellites. The commensurability relation between the satellites *J1*/*J2* is 1/2, between *J1*/*J3* – 1/4 and between *J2*/*J3* – 1/2. Moreover, the commensurability of periods of *J2*/*J4* is 3/7 and of *J1*/*J4* – 1/9. There exists also the commensurability relations between *1979J1*–*1979J3*/*J5* – 3/5, between *1979J1*–*1979J3*/*1979J2* – 3/7 and between *1979J1*–*1979J3*/*J1* – 1/6.

It seems very probable that the Jupiter's satellites, which make the groups (i), (ii) and (iii), are the "regular" satellites, whereas the satellites, which make the groups (iv) and (v), are probably captured minor planets.