ABOUT THE SIZE OF THE COSMICAL SYSTEMS

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In an attempt to explain the apparent absence of satellites of the planets' satellites we have investigated two kinds of hypothesis formally independent of each other. The analysis, though qualitative, suggest that the same parameter links the examined hypothesis.

We are describing here in a very qualitative way an attempt to link two lines of thought of contemporary cosmogony that mutually remain rather extraneous. The idea arose seven years ago in an unsatisfactory effort to explain the apparent absence of satellites of the planets' satellites. We do not know if this question was formulated before 1954, but no doubt it would have reached us if it had been considered interesting. We thought that the solution to this problem would be a contribution to the knowledge of the structure and evolution of cosmical system in general. For, we may well suppose (cosmogonical hypothesis) that the formation of a planetary system is an aspect or event in the evolution os a star, or on the contrary we may suppose (cosmological hypothesis) that the formation of a planetary of a planetary system is ruled by very general laws that must be fulfilled whenever discrete masses are formed from diffuse masses. These two types of hypothesis are apparently so very unlike each other, that it would have seemed curious that the existence of a moon of the Moon should be approved (or vetoed) by cosmological reasons and, simultaneously, by cosmogonical reasons.

To deal with the problem from a cosmological point of view we have made use of Lambert's idea, as later developed by Charlier, of a universe structured in systems of different orders. It is easy to see that Charlier's inequality is verified in the planetary system, and thus the size of the greatest orbits of the satellites' moons can be deduced, in case they exist. So it follows that Jupiter's most massive satellites would not always have room for their moons, but our Moon would. If instead we apply Eigenson's criteria, it follows that no satellite can have moons, and thus it becomes clear that the probable number N_k of systems forming a system of $k + 1$ order, is enough to decide the existence of k-order systems.

Regarding the cosmogonical treatment of the problem, we have combined a turbulence process with the stability criterium due to Fesenkov, and have obtained that, at least, conditions could have been favourable for the formation of a moon of Titan. The reality of this process depends fundamentally on the existence of turbulence. For this purpose we have investigated Jaschek's empirical law relative to the size of the planets' satellites systems and, after having discussed its numerical significance, we have found that for dimensional reasons the distribution of the kinetic energy in the original turbulence field leads to a potential law such as the mass-size empirical law found by Jaschek; the only requisite to be observed is that the laboratory measures concerning Prandtl's law and Reynolds number may be extrapolated to cosmical conditions, i.e., that Prandtl A coefficient should be negative. Should that happen, a turbulence field would be the straightest explanation for the so called hierarchy of systems, because this would correspond to the original turbulence spectrum; moreover it would force us to anticipate a limit to the numerical validity of Jaschek's relation, of which on the other hand, we may have a glimpse when applying the relation to globular clusters and galaxies. Regarding this we may connect the behaviour of A, of the Rayleigh coefficient, and of the mean free path, with the size of the system, and conjecture that, for a given cosmical energy distribution, the turbulence eddies must have received and transferred energy sums dependent on the scale of each level. That is why it becomes interesting to compare the energy values corresponding to the different structural orders already known. The discussion of such numbers is under way.

The paper in full will be published elsewhere.