ON THE NATURE OF REGULARITIES IN THE RADIAL STRUCTURE OF SATURNIAN RINGS

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The theory [1] based on the consideration of a cosmic planetary system (PS) as a spatially limited oscillating system with many degrees of freedom predicts the formation of annular features of the type of radial standing waves (SW). The gravitating matter consisting bodies (satellites) of different sizes accumulates itself in the SW nodes and loops as in peculiar traps. The matter of Saturnian system that consists of different bodies is of undoubted interest from this point of view. The theory permits to obtain a wave length (WL) of the principal mode of SW in dependence on the central body's mass M: $a = \beta M^{7/9}$, where β is the integrating constant. In particular for the system of Saturn $a_h = 74739$ km. A radial matter distribution in the Saturnian rings corresponds to the SW properties adduced below:

1. WL of the structural features and their nodes and loops positions are stable during a long time. The D, C, B and A Rings can be considered as harmonics with a wave length $a_5 = a_h/5 = 14948$ km. Its nodes coincide with the edges of the A, B and C Rings and with the B Ring middle, which separates the inner and outer halfs of that Ring essentially different by the optical depth and structure [4] (see table). Analogous structures are appeared within the asteroidal belt [2].

2. Within the principal mode of SW a set of all higher harmonics is generated. SW with the WL $a_{70} = a_h/70 \approx 1000$ km is displayed within the C Ring and with the WL $a_{180} \approx 400$ km within the Cassini Gap. Though, these small structures have to be formed also as independent SW within the limiting bounds of the larger features (including C Ring and Cassini Division too). Under such conditions more small structures are divided into more and more finest ones. Such peaked oscillations of the optical depth (W-features) are observed through the whole width of the Rings down to the resolution limit of the Voyager TV system (Fig. 1). The F Ring displays more than ten fine density waves within 60 km width and its denser part has the same

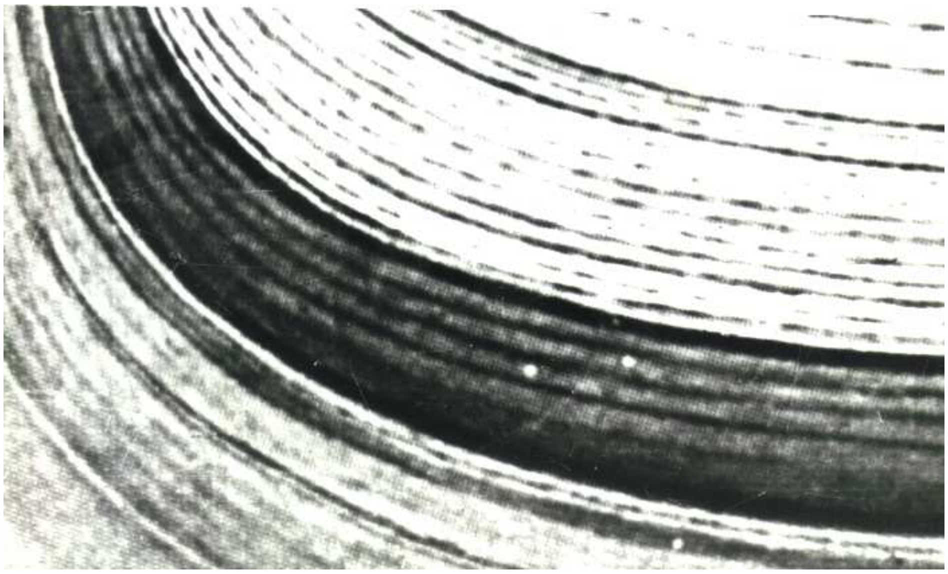

Figure 1: Image of the part of Saturnian rings composed by computer according to Voyager-2 data. Cassini Division is more dark

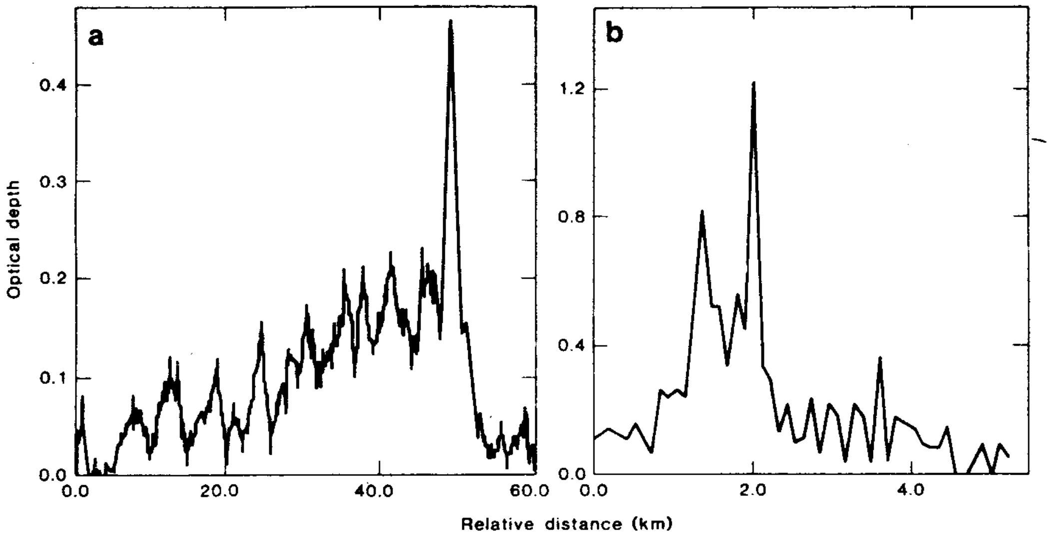

Figure 2: Optical depth of the F Ring (a) and its thickest part (b) [6]

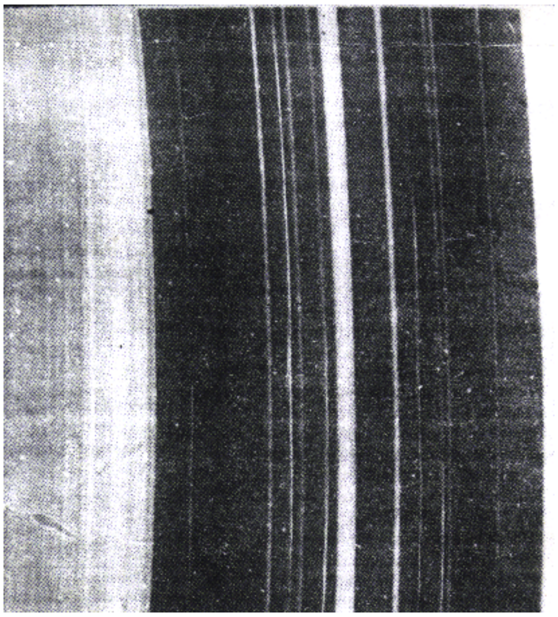

Figure 3: Encke Division with the inner ringlets [6]

quantity of the thickenings and rarities (Fig. 2) within 5 km. There are an evident dense central ringlet and many fine ringlets on the commensurable distances in the Encke Division (328 km width) (Fig. 3).

3. Wherever polydisperse matter is to be presented, its separation have to take place in accordance with its pliability (inertness) to perturbations. Analysis [4] of the Voyager observations shows an increase of the number of fine particles on the edges of the A and B Rings. Ultra-violet's absorption is found within the Cassini Gap in the nodes of the above mentioned a_{180} wave, while a radio signal passes it without losses [5, 7]. A dusty substance is seen as bright belts outside the A and B Rings and in the Cassini Gap on the images obtained by Pioneers on the dark side in the diffused light. Analogous separation of the large and small matter fractions are appeared also within the asteroidal belt [3].

	n	$a_t = a_h + na_h/5$, 10^3 km	Obs	$a_0 - a_t$
D Ring inner edge	–0.5*	67.2	67.0	–0.2
C Ring inner edge	0	74.7	74.5	–0.2
B Ring inner edge	1	89.7	92.0	2.3
B Ring middle	2	104.6	104.0	–0.6
A Ring inner edge (Cassini Gap middle)	3	119.6	119.8	–0.2
A Ring outer edge	4	134.5	136.8	2.3

* – Mode of the higher degree.

We explain some discrepancies by the influence of other structural mechanisms, *e.g.*, by tides and resonances with the satellite's distances. That's why SWs are not displayed clearly everywhere or displayed with broken regularities.

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