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Self-energy of Saturn's rings agglomerates

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Abstract

The vivid appearance of the outer regions of Saturn's rings points to a balance of ongoing fragmentation and coagulation processes, this idea finds support especially in the F ring, where collisional processes occur on an almost daily basis due the perturbation of the satellite Prometheus and in addition due the presence of moonlets. In order to quantify this balance in a kinetic theory we propose to calculate the resistivity of agglomerates, "dynamic ephemeral bodies", against rupture due collisional processes. Earlies studies show us that the resistivity of an aggregate is divided into two stages: "strength regime" and "gravitational regime". Early in their formation, the agglomerates are supported basicly by the "glue" between the particles (adhesion) - "strength regime". Later, after the aggregate reaches a size in which the self-gravity energy really becomes the main energy that holds the cluster's constituents together, we come to the "gravitational regime". Hence, we considered adhesion and gravity as particle interactions to calculate the self-energy of ring's aggregates. Using a Balistic Particle Cluster Aggregate Model, we varieted the the densities of the aggregates and the size distribution of their constituents, and calculated their self-energy pointing the transition between the "strength" to "gravitational regime". The transition between the regimes occurs at house-size aggregates, fact that fits to the cut-off on the rings' small bodies population, once the aggregates at "strength regime" are expected to be weaker than at "gravitational regime".

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