SMALL ASTEROIDS WITH "DUSTY" ATMOSPHERES? A. Campo Bagatin[1], and the MarcoPolo-R working group on mechanical properties. [1]Universidad de Alicante (DFISTS, P.O. BOX 99, 03080 Alicante, Spain. acb@ua.es)

Introduction: An increasing number of Near Earth Asteroids (NEAs) in the range of a few hundred meters to a few kilometers in size are found with relatively high spin rates (from ~2.3 to less than 4 hr, depending on taxonomic type). Due to their high spin rate local acceleration near their equators may in some case be directed outwards. What are the effects of that on surface material at asteroid latitudes close to 0º?

Motivation: Both coherent bodies and gravitational aggregates (GA) may stand spin rates higher than the critical ones for fluids found by Chandrasekhar [1]. In the former case that is due to internal solid state forces while in the latter case shear strength may easily appear as a consequence of friction among GA components [2]. NEAs coming from the asteroid belt are believed to be mostly GA in the range ~0.5-1 km to ~50 km [3] due to their collisional history. Once in the inner Solar System, NEAs often undergo spin up (and down) evolution through the non-gravitational YORP effect causing their components to disperse, to shed mass or to fission and eventually form binary, multiple systems or asteroid pairs [4, 5]. The end state of those events often is an object spinning above any Chandrasekhar stability limit, kept together by friction and characterized in some case by the presence of an equatorial "bulge", as shown by radar images [6].

In the case of some NEAs, the centrifugal force acting on surface particles at equatorial latitudes may overcome the gravitational pull of the asteroid itself, having the opportunity to leave its suface.

As centrifugal is a contact force, leaving the surface does not mean that particles are lost form the asteroid, in fact, as soon as particles lift off they move only under the gravitational field of the asteroid so that they may levitate for some time, land on the surface and repeat this cycle over and over. Relatively small particles may be lost as they undergo solar pressure force able to subtract them to the asteroid's gravity while they are levitating.

Centrifugal and gravitational forces have the same dependence on a given particle mass, their action is then independent on mass itself: small dust particles may leave the surface as well as larger boulders. Other forces may act on small particles, like electrostatic forces or molecular forces, that may stick them together and still undergo the same effect as a clump.

Results: We have studied the possibility that some NEAs show that behaviour and we present some results, taking into account the mentioned forces and effects. The consequences for planned missions to NEAs with these characteristics are also discussed.

References:

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