SOME PROBLEMS OF THE EVOLUTION OF ASTEROIDS – RUBBLE PILE. G. A Leikin, A. N. Sanovich. Sternberg Astronomical Institute, Moscow 119899, Russia.

We consider the evolution of an asteroid – rubble pile – as an isolated object. Evidently, we can distinguish two processes: distant interactions, where there is no direct contact between separate fragments, and close contact interactions, where the fragments collide with one another. The process of distant interaction is essentially similar to that of the evolution of scattered star clusters and, in itself, leads to the ejection from the pile of individual fragments with maximum energy and angular momentum, the distribution of which may roughly be described by a Maxwell distribution. At the stage of distant interaction, there is practically no inelastic loss of energy.

In contrast, the process of contact interaction is accompanied by a loss of kinetic energy of the fragments, spent in disrupting the rock in collision and contact events, which brings the fragments closer and eventually leads to a quasi-spherical form (or for those retaining an angular moment – quasi-elliptical form) for the rubble pile in the absence of external perturbations.

It is clear that the evolution of a closely bound pile leads to the formation of a plentiful fine-fraction on the surface of the fragments. Such an asteroid structure should have an observable density considerably lower than solid rock.

Unprotected from cosmic rays and solar radiation, areas of the surface on the fragments should become positively charged through ejection of electrons. This charge should be sufficient to balance the fluxes of positively and negatively charged particles. Thus the fragments should have a thin atmosphere of dust of small extent, or possibly a general atmosphere enclosing all the fragments.

Such a rubble pile with a dust atmosphere differs from a cometary nucleus only in the absence of a volatile gas component, which is usually considered the cause of the appearance of cometary dust.

In the case of an asteroid rubble pile, the dust is produced by the interaction of fragments of the pile; however, its interaction with the solar corpuscular fluxes does not differ from that of cometary dust and should therefore show the same effects.

In particular, the observation of ‘cometary’ activity at great heliocentric distances doesn’t necessarily indicate the cometary nature of the active bodies – it could be a result of an asteroid–rubble pile entering the solar corpuscular flux. The turbulisation of the magnetized flux, on interaction with the asteroid–rubble pile may lead to short-period bursts of activity (especially on interacting with a rotating asteroid), and in some cases, on turbulent disruption of the dust atmosphere of the asteroid, to the formation of an ‘asteroid phantom’ – a magnetized cloud of dusty plasma.