Aggregate structure of comet 67P/Churyumov-Gerasimenko

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The Rosetta mission to comet 67P/Churyumov-Gerasimenko has provided plenty of data to understand what comets are made of. The thermal and mechanical properties of dust aggregates encapsulate information on their internal structure. In this study, we investigate whether the comet is made of homogeneous or hierarchical aggregates using theoretical models of the thermal inertia and tensile strength of dust aggregates (Arakawa et al. 2019, Tatsuuma et al. 2019). We found that it is difficult to explain the tensile strength of the comet if the comet is a homogeneous aggregate constituted by micron-sized dust grains. Then we also calculated the thermal inertia and tensile strength of hierarchical aggregates. We analytically derived the physical properties of hierarchical dust aggregates and compared our theoretical model with experimental data of the tensile strength of hierarchical aggregates (Blum et al. 2014, Brisset et al. 2016). We found that the thermal inertia and tensile strength of the comet are consistent with the hierarchical aggregate constituted by cm- or dm-sized aggregates, which is basically consistent with the result of Blum et al. (2017). These findings indicate that the icy planetesimals may form via accretion of cm- or dm-sized compressed dust aggregates in the solar nebula.

Keywords: Comet, Thermal inertia, Tensile strength

