Internal structure of pebble-pile comets inferred from thermal and mechanical properties of dust aggregates

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The *Rosetta* mission has provided new data to better understand what comets are made of. The weak tensile strength of the cometary surface materials suggests that comet 67P/Churyumov–Gerasimenko is a hierarchical dust aggregate formed through gravitational collapse of a bound clump of small dust aggregates so-called `pebbles' in the gaseous solar nebula. Recently, we calculated the thermal inertias and thermal skin depths as functions of the size of pebbles (Arakawa & Ohno 2020). We found that the thermal properties of the comet are consistent with the hierarchical aggregate of cm- to dm-sized pebbles. This estimate is also consistent with the mechanical strength of the nucleus. In addition, we reanalyzed the stickiness of icy dust particles using a viscoelastic contact model. Our results indicate that not only H_2O ice but also CO_2 ice particles could easily grow into cm-sized large pebbles in the solar nebula (Arakawa & Krijt 2021), and this size estimate may be consistent with that from thermal and mechanical analyses on comet 67P.

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