

Ways out of the cometary activity paradox

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Rosetta has shown ubiquitous dust and gas emission of comet 67P over most of its orbit. The classical explanation of cometary activity is that gas sublimates (mostly H₂O inside ~3 AU and CO and CO₂ further out) and the drag force of the gas carries away the cometary dust. However, calculations show that drag force of the gas is significantly less than the tensile strength of the cometary material as measured by Rosetta and in the laboratory. Therefore, the process of cometary dust activity is not fully understood.

We will report on results of an ISSI team trying to solve the paradox. We will discuss the following processes that may trigger cometary activity:

- An ice-free cohesion-less surface layer, weak enough to be overcome by gas-drag
- Highly volatile material (CO₂ or O₂) embedded into water ice, creating overpressure
- Overpressure due to an impermeable dust/organics layer at the surface (“pressure-cooker effect”)
- The role of fractures (weakening the cometary material and increasing heat flux)

The pros and cons of each process will be discussed in the light of Rosetta results, and we review the understanding of the physics of cometary activity after Rosetta.