Global Composition of Dust at Comet 67P/Churyumov-Gerasimenko as Measured by the COSIMA/Rosetta Mass Spectrometer


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1. The Rosetta Mission: Comet 67P

Comet 67P
- Dimensions: ~4 km x 3 km x 2 km
- Orbital period: 6.44 yr
- Perihelion: 1.24 AU

The Rosetta Mission
- Journey to the comet: 10 years
- Rosetta orbiter (11 instruments)
- Philae lander (10 instruments)

The COSIMA instrument
- Time-of-flight mass spectrometer [1]
- On board the Rosetta orbiter
- Aim: Analysis of the chemical composition of 67P’s dust
- Collect (1), Image (2) and Analyze (3)

COSIMA target
- 21 targets exposed
- >35,800 particles [2]
- Size: ~10 to 1000 µm
- ~250 particles analyzed

2. COSIMA analysis

- Similar mass spectra signatures [3]
- Always a mixture of carbonaceous matter and mineral phases (ion beam size: 30 x 50 µm²)

3. Global composition

67P’s dust compared to comets Halley and Wild 2
- For references see Figure 6 in [3]
- 67P’s dust is chondritic within a factor of 3, C excepted
- Consistent with the composition of Halley and Wild 2

- Mass ratio of organic to mineral matter in 67P’s dust
  - Based on the elements quantified in [3, 4] and H/C = 1.04 ± 0.16 [5]
  - Assumptions:
    (i) S/Fe = 0.5 (chondritic)
    (ii) C, H and N in organic
    (iii) O/Si = 4 in mineral (SiO₄) and the remaining O in the organic phase

4. Summary

- Dust particles are carbon-rich: ~45% organic matter in mass
- Macromolecular carbonaceous matter [6] is a major non-volatile component of 67P dust

References
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COSIMA was a time-of-flight secondary ion mass spectrometer on board the Rosetta orbiter. From August 2014 to September 2016 the instrument performed in situ analysis of the dust particles ejected from comet 67P/Churyumov-Gerasimenko, before and after perihelion. COSIMA collected more than 35,000 particles at a low impact velocity (< 10 m/s) and analyzed about 250 of them with size ranging from ~50 to ~1000 µm.

We will report the global composition of the cometary dust as deduced from COSIMA measurements. The average elemental composition measured for 67P’s dust will be compared to previous results obtained from the Giotto and Vega missions for comet 1P/Halley and the Stardust mission for comet 81P/Wild 2, to the composition of Chondritic Porous Interplanetary Dust Particles (CP-IDPs) and to the CI chondrite composition.
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**P23G (CC) Hall A-C (Poster Hall)**

**Tuesday 1340h**

**The Origin, Evolution, and Fate of Comets: New Results from Rosetta, Other Missions, and Ground-Based Observations I Posters (joint with SH, SM)**

*Presiding: Bonnie Buratti*, Jet Propulsion Laboratory; *Mathieu Choukroun*, Jet Propulsion Laboratory; *Matt Taylor*, European Space Agency;

Abstract

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