Recent Results on Cometary Dust by Rosetta/COSIMA

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1. Introduction

The Cometary Secondary Ion Mass Analyzer (COSIMA) was a dust analysing instrument on board the Rosetta spacecraft which orbited the comet 67P/Churyumov-Gerasimenko (here after 67P) for more than two years before landing on the nucleus and thus ending the mission. COSIMA collected dust particles from the inner coma of 67P on metal target plates, imaged them, and used its ToF-SIMS to probe their composition.

2. Dust physical properties and flux

The registered particles have sizes between 14\(\mu m\) (image resolution) and about 1 mm. Most break apart on hitting either the funnel during entry or the target plate and can be classified according to their structure [4]. The internal strength of these particles was found to be on the order of \(10^3\) Pa, with sub-units of 30-40 \(\mu m\) being more stable [3]. The pre-perihelion flux has been analysed in [5]. More recently, [6] analysed the size distribution of collected dust for the whole mission (Fig. 1).

3. Composition

The cometary dust is composed of partly organic and partly silicatic phases. [8] and [2] found many rock forming elements in the dust, and the these elements (with the notable exceptions of C and Si) show in their abundances some similarities with carbonaceous chondrites [9] (Fig. 2). For the organic phase, the spectral signature of the cometary organic matter is mostly present in the low mass range (Fig. 3). This is related to the presence of a complex organic matter which could present some similarities with the IOM extracted from carbonaceous chondrites [1]. The isotopic ratio for oxygen shows VSMOW values within the uncertainties, see Fig. 4, [7].

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Figure 2: Ternary diagram of ion counts for the elements Mg, Fe and Al. Each data point marks the average abundance over a randomly chosen set of spectra from a specific sample.

Figure 3: Mass spectra of cometary particles Keneth and Juliette (first and second row), and IOM from CI chondrites Orgueil and Murchison. Measurements on the target substrate and the sample are distinguished by the black and red color, respectively.

Figure 4: Oxygen isotop ratios for 67P dust compared with other measurements

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