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Oxygen Isotopes in H_2O in the coma of 67P/Churyumov-Gerasimenko measured with ROSINA/DFMS

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Abstract

Comets are widely considered to contain some of the most pristine material in the Solar System [1]. The degree of isotopic fractionation – the enrichment or depletion of an isotope in a molecule, relative to its initial abundance – observed in a comet is sensitive to the environmental conditions at the time of the comet's formation [2]. Therefore, measurements of isotopic abundances in cometary ices reveal important information regarding the early Solar System's composition, density and temperature and the amount of radiation present before the accretion of solid bodies, when the molecules were being formed during the chemical evolution of the presolar cloud to the protosolar nebula and protoplanetary disc. They are therefore vital to understanding and reconstructing the history and origins of material in the Solar System [3].

The $^{16}O/^{18}O$ ratio of CO_2 in the coma of the comet 67P/Churyumov-Gerasimenko was previously measured by Hässig et al. (2016) [2] with the ESA spacecraft Rosetta's ROSINA instrument package's Double Focusing Mass Spectrometer (DFMS) and found to be consistent, within 1σ uncertainty, with solar system abundances calculated by Lodders (2003) [4] but not with solar wind measurements by McKeegan et al. (2011) [5].

This study aims to examine the $^{16}O/^{18}O$ ratio of H_2O in the coma of the comet 67P, as measured by the Rosetta/ROSINA DFMS, and to compare it with solar values, as well as against the results from the aforementioned earlier investigation by Hässig et al. (2016) [2] into the $^{16}O/^{18}O$ ratio of CO_2. A long-term study of the $^{16}O/^{18}O$ ratio in H_2O will also be performed to investigate if changes in this ratio occurred over the course of the comet's passage through the inner heliosphere.

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