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Organic compounds from Enceladus in E ring ice grains

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Water ice dominates the composition of the micron and sub-micron sized dust particles in Saturn's E-ring, a ring constantly replenished by active icy jets of the moon Enceladus. Details about the composition of this tenuous, optically thin ring can only be constrained by in situ measurements. The Cosmic Dust Analyzer (CDA) onboard Cassini investigates the composition of these grains by cationic time-of-flight mass spectra of individual ice grains hitting the instruments target surface. From these spectra three compositional types of E ring ice grains have been identified previously: Type-1: Almost pure water, Type-2: Enriched in organics, and Type-3: Enriched in salt.

Unlike Type-1 and 3, organic-enriched Type-2 spectra have not yet been investigated in depth. Here we report a detailed compositional analysis of this type. The spectra analysis is supported by a laboratory ground campaign in Heidelberg. As expected, we find more complex and refractory organic molecules in ice grains compared to the volatile organic material emitted by Enceladus in the gas phase. In contrast to Types 1 and 3, Type 2 spectra display a great compositional diversity, which indicates varying contributions of several organic species. So far we have identified characteristic fragment patterns of at least three classes of organic compounds: aromatic species, amines, and carbonyl group species. The diversity of the identified species requires different generation scenarios for different organic bearing ice grains.