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Chemistry and modeling of cometary comae

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Cometary nuclei offer a unique window into the early stages of our solar system. A detailed analysis of the composition of these bodies will help us derive constraints for planetary formation models. To derive such information a sound statistic based on a great number of samples is necessary. This is especially important if we are looking for the differences among comets which might tell us about the inhomogenities in the early solar system.

Until now only 3 comets have been closely visited by a spacecraft. While Giotto and Deep Space 1 performed only remote sensing during the flyby, Stardust collect for the first time samples in a cometary coma. The future will bring us even more exiting mission to comets, with Rosetta and Deep Impact already on its way. However the number of comets which can be studied by planetary mission will always be small compared to the whole ensemble of observable comets. The data collected during these missions will provided us with "ground truth" for selected comets.

Sound statistics on the whole ensemble of comets can only be derived from ground based observations of comets. Among the methods used in remote observation of comets optical spectroscopy has the significant advantage of being usable for almost every comet and can cover a wide range of heliocentric distances. The disadvantage is however that only daughter species are observable in the visible wavelength range. In order to derive compositional information from these observations a good understanding of the chemistry within the coma is necessary and the physics of the cometary nucleus is necessary.

Within this talk the chemistry of the C2 and C3 parent molecules will be used as an example of connecting ground based observation of daughter species to the abundance ratio of the nucleus using a detailed modeling of the chemistry on the coma. It will also been shown how these derived ratios can be used to derive limits on the formation region of a cometary nucleus.

References

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