THE VOLATILE COMPOSITION OF THE PERIODIC COMET 8P/TUTTLE AS MEASURED WITH CRIRES AT ESO's VLT OBSERVATORY

M. Lippi[1], M. J. Mumma[2], G. L. Villanueva[2], M. A. Di Santi[2], B. Bonev[2], H. Boehnhardt[1]
[1]Max Planck Institute for Solar System Research, Max Planck str. 2, D-3719, Katlenburg Lindau, Germany, [2]Solar System Exploration Division, MS 690.3, NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA.

Introduction: The composition of cometary nuclei is belived to reflect physical and chemical properties of the Solar System prevailing in the period of it's formation. Nowadays, comets mainly reside in two reservoirs: the Oort cloud and the Kuiper belt region. However, the formation regions of comets in the protoplanetary disk is still an open question. Differences in composition may exist for comets formed in different regions, which may be related to a chemical gradient in the proto-planetary disk. High resolution spectroscopy of bright comets in the mid-IR region constitute a powerful tool to detect parent molecules release from cometary nuclei. The develop of new instruments in the last decade permitted the identification of two distinct classes of comet, based on their organic content: "normal organic" and "depleted organic" [1-3].

Here we present results on the composition of comet 8P/Tuttle, an Oort cloud comet, now in a Halley type orbit. Observations were performed in January - February 2008 using CRIRES at ESO VLT (at Cerro Paranal in Chile) for high dispersion (up to 100,000) spectroscopy in the wavelength region 3-5µm. We measured H_2O, CH_4, CH_3OH, C_2H_6, H_2CO and CO (see Figure 1).

We compare our results for 8P/Tuttle with the composition of two other comets in Halley type orbits and with 5 Oort Cloud comets. If Halley type comets came from the inner part of the Oort Cloud as proposed in [4], we see no common characteristics that could distinguish such comets from those stored in the outer Oort cloud.

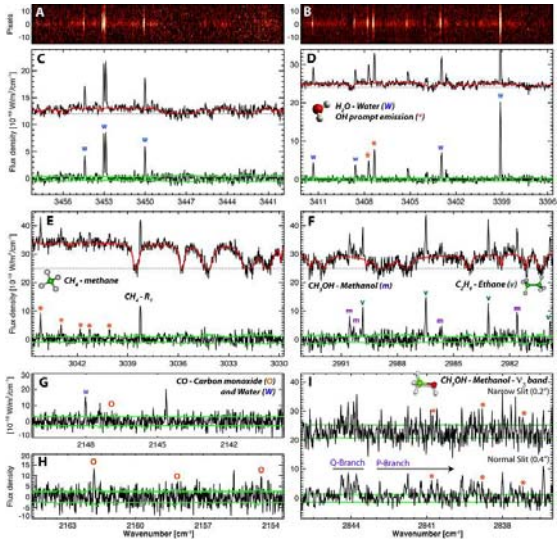

Figure 1: Detection of parent volatiles and dust in comet 8P/Tuttle in January 2008. The thick red line in panels C-F represents the cometary continuum convolved with a synthetic transmittance spectrum of the terrestrial atmosphere, and the green lines in panel C-I indicate the noise envelope (±1σ). Panels A and B show echellograms for CRIRES detectors #2 and #4 of the 2.9µm wavelength setting. Panels C and D show the corresponding spectral extracts. Panels E and F show detection of CH_4, C_2H_6, CH_3OH and OH*, as measured with the setting near 3.3µm. Panels G and H show detection of water and carbon monoxide.

References: [1] J. Crovisier (2007) in press (astro-ph/0703785). [2] D. Bockelee-Morvan et al. (2004) *Comets II* , 391-423. [3] M. J. Mumma et al. (2003) *Adv. Sp. Res. 31 (no 12)*, 2563-2575. [4] H. F. Levison (1996), *Astr. Soc. Pac. Conf.Proc.107*, pp. 173-191.