THE DEPLETED ORGANIC COMPOSITION OF COMET C/2000 WM_1 (LINEAR) AS REVEALED THROUGH INFRARED SPECTROSCOPY. Y. L. Radeva[1,3], B. P. Bonev[2,3], M. J. Mumma[3], M. A. DiSanti[3], G. L. Villanueva[3], K. Magee-Sauer[4], E. L. Gibb[5], H. A. Weaver[6]
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Understanding the chemical diversity of comets is essential to modeling the Solar System's formation and evolution. A key objective is to establish a cometary taxonomy based on parent volatiles (and dust). Infrared spectroscopy (of ro-vibrational transitions) enables unique sampling of symmetric hydrocarbons released from the cometary nucleus. With NIRSPEC, these symmetric species are sampled simultaneously with water and other compounds, eliminating most sources of systematic error and providing the basis for highly accurate comparisons among comets.

High-resolution infrared spectra of the Oort cloud comet C/2000 WM_1 (LINEAR) were acquired on 23-25 Nov. 2001, with the Near Infrared Echelle Spectrograph (NIRSPEC) on the Keck II telescope. We report detection of multiple parent species: H_2O, HCN, CH_4, C_2H_2, C_2H_6, CO, H_2CO, and CH_3OH, and we present production rates, rotational temperatures, and mixing ratios (refer to Figure 1 for sample spectra.)

We find that C/2000 WM_1 (LINEAR) is depleted in its organic chemistry (with respect to water), compared with "organics-normal" comets from the same dynamical reservoir (consistent with the results presented by Biver et al. 2006.) Like other depleted comets, this comet might have originated closer to the young Sun, than the organics-normal comets, before its ejection to the Oort cloud (see also Mumma et al. 2001, Villanueva et al. 2006, Kobayashi et al 2007, Dello Russo et al. 2005.)

References:

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Figure 1: Spectra from comet C/2000 WM_1 (LINEAR)