Towards a Taxonomy for Comets based on Composition, with Relevance to Delivery of Volatiles to Earth. M. J. Mumma[1], [1]Solar System Exploration Division, Mailstop 690, NASA Goddard Space Flight Center, Greenbelt, MD 20771 (michael.j.mumma@nasa.gov).

Summary: What are the principal agents that connect the seemingly distinct domains of icy planetesimals, the origins of Planetary Systems, of Earth and its analogues, and of Life itself?

Strong gradients in temperature and chemistry in the proto-planetary disk, coupled with dynamical models, imply that comets from the Oort Cloud and Kuiper Disk reservoirs should have diverse compositions. The primary volatiles in comets (ices native to the nucleus) provide the preferred metrics that test (and confirm) this view, and taxonomies based on them are now beginning to emerge [1, 2, 3].

Chemical composition aside, cosmic parameters such as nuclear spin temperatures (e.g., for H_2O, NH_3, and CH_4), and of enrichment factors for isotopologues (e.g., D/H in water and hydrogen cyanide, $^{14}N/^{15}N$ in CN and HCN) provide additional important tests for the origin of cometary material and inform us of Earth's cometary heritage. By delivering volatiles to early Earth during the Hadean epoch, comets may well have enabled the origin of life.

I will provide an overview of these topics, of the molecular science involved, and of the emerging implications for the origin of Earth's water and its prebiotic organics.

References: [1] Mumma M. J. and Charnley S. B. (2011), *Ann. Rev. Astron. Astrophys.* 49, 471-524.
[2] DiSanti M. A. and Mumma M. J. (2008) *Space Sci. Rev.* 138, 127-145. [3] Crovisier J. et al. (2002) *Earth, Moon, Planets* 105, 267-272.