



## The Huygens Gas Chromatograph Mass Spectrometer Investigation Of Titan

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A decade ago, on 14 January 2005, the Huygens probe of the Cassini-Huygens mission descended through the smog filled atmosphere of Titan and landed on the surface, revealing for the first time the extraordinary nature of Saturn's largest moon. One of the six payload instruments, the gas chromatograph mass spectrometer (GCMS), was crucial for measuring the composition of the atmosphere and the surface of Titan [1,2]. Most of the GCMS findings were "firsts", including the first direct identification of molecular nitrogen as the bulk constituent of the atmosphere, first vertical profile of Titan's second most abundant volatile, methane, first determination of primordial and radiogenic argon, first quantification of a number of stable gas isotopes, and the first measurements of the make-up of Titan's surface. These data are key to understanding why Titan is so unique amongst planetary moons in possessing a massive atmosphere [3], how Titan maintains a cycle of methane complete with surface reservoirs, evaporation and condensation like the hydrological cycle on earth [3,4,5], and what is responsible for the photochemical smog on Titan that plays a central role in the very existence of an atmosphere on Titan [3]. This presentation will discuss the GCMS investigation and how it helped shape our current view of Titan. [website for downloading pdf's of relevant papers: [www.umich.edu/~atreya](http://www.umich.edu/~atreya)]

[1] Niemann, H. B. et al., The abundances of constituents of Titan's atmosphere from the GCMS instrument on the Huygens probe, *Nature* 438, 779-784, 2005.

[2] Niemann, H. B. et al., The composition of Titan's lower atmosphere and simple surface volatiles as measured by the Cassini-Huygens probe gas chromatograph mass spectrometer experiment, *J. Geophys. Res. (Planets)* 115, 12006, 2010.

[3] Atreya S. K., R. D. Lorenz and J. H. Waite, Volatile origin and cycles: Nitrogen and methane, in Titan from Cassini-Huygens, R. H. Brown, J. P. Lebreton and J. Waite, (eds.), Springer Dordrecht, Heidelberg-London-New York, pp. 177-199, 2009.

[4] Atreya, S. K. et al., Titan's Methane Cycle, *Planet. Space Sci.*, 54, 1177-1187, 2006.

[5] Lunine, J. I. and S. K. Atreya, The Methane Cycle on Titan, *Nature Geoscience*, 1, 159-164, 2008.