

Benzene or Phenyl in Titan's Upper Atmosphere?

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We argue that the benzene (C₆H₆) reportedly detected in Titan's upper atmosphere by the Ion Neutral Mass Spectrometer (INMS) experiment (Waite et al. 2005, 2007) is actually due to a combination of phenyl (C₆H₅) and benzene. The benzene signal near mass 78 in the INMS spectra is produced by benzene created in reactions on the walls of the INMS. This interpretation is supported by a time lag in the mass 78 signal relative to Titan closest approach, which is due to the finite time constant characterizing the wall chemistry. This interpretation also makes it easier to understand the densities of benzene and phenyl. Benzene, created by ion chemistry at high altitudes, is quickly photolyzed to produce phenyl. The phenyl diffuses downward where radical-radical reactions reform benzene or create heavier species. Because of the large photolysis rate, the density of phenyl in Titan's upper atmosphere should be larger than the density of benzene, thereby reconciling the inferred densities with photochemical production rates.