Hydrocarbon Aerosols in Titan's Troposphere

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The role of hydrocarbon aerosols in Titan's lower atmosphere, including cloud processes, the formation of rain, and the formation of Titan's lakes, is a main topic in planetary science. Analogies to processes in Earth's atmosphere are often being invoked. We report infrared spectroscopic measurements of methane, ethane and other hydrocarbon aerosols performed in the laboratory under conditions mimicking Titan's troposphere. The results reveal a multifarious phase behaviour of these hydrocarbon aerosols that strongly depends on the presence of other hydrocarbon gases or condensates. Our data imply that in many regions of Titan's lower atmosphere liquid and supercooled methane and ethane droplets might be more important than solid methane and ethane ice particles for various cloud processes and for the formation of Titan's lakes. In the light of our results, cloud models need to be revised to account for supercooled liquid droplets.

Keywords: Titan; methane aerosol; ethane aerosol; phase behavior; supercooling; vibrational dynamics.

References

[1] R. Signorell and M. Jetzki, *Phys. Rev. Lett.* **98**, 013401 (2007).
[2] O. Sigurbjornsson and R. Signorell, *Phys. Chem. Chem. Phys.* **10**, 6211 (2008).
[3] O. Sigurbjornsson, G. Firanescu and R. Signorell, *Annu. Rev. Phys. Chem.* **60**, 127 (2009).
[4] C. C. Wang, P. Zielke, O. Sigurbjornsson, C. R. Viteri and R. Signorell, *J. Phys. Chem. A* **113**, 11129 (2009).
[5] C. C. Wang, S. K. Atreya and R. Signorell, *Icarus* doi:10.1016/j.icarus.2009.11.022 (2010).
[6] C. C. Wang, E. K. Lang and R. Signorell, *Astrophys. J. Lett.* article in press (2010).
[7] T. C. Preston, G. Firanescu and R. Signorell, *Phys. Chem. Chem. Phys.* submitted (2010).