Aerosol-Organic Condensates-Lake Interactions on Titan

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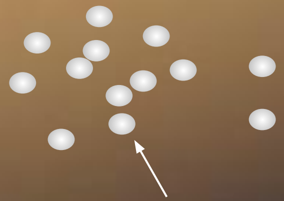
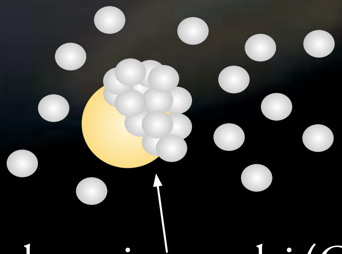
Titan: the haze, cloud, and lake

<u>Homogeneous nucleation</u>



Cloud Condensates:
hydrocarbons/nitriles

<u>Heterogeneous nucleation</u>



Cloud condensation nuclei (CCN)/haze particles

Photochemistry in Titan's atmosphere produces <u>simple organic compounds</u> which could condense to form clouds. <u>Heterogeneous nucleation</u> would be more efficient for cloud formation, with the <u>refractory complex organics</u> (haze particles) as the cloud condensation nuclei (CCN). However, the nucleation efficiency of the haze particle is unknown for most Titan condensates. These cloud condensates, after formed, could also fall onto the lakes and interact with the lake liquids.

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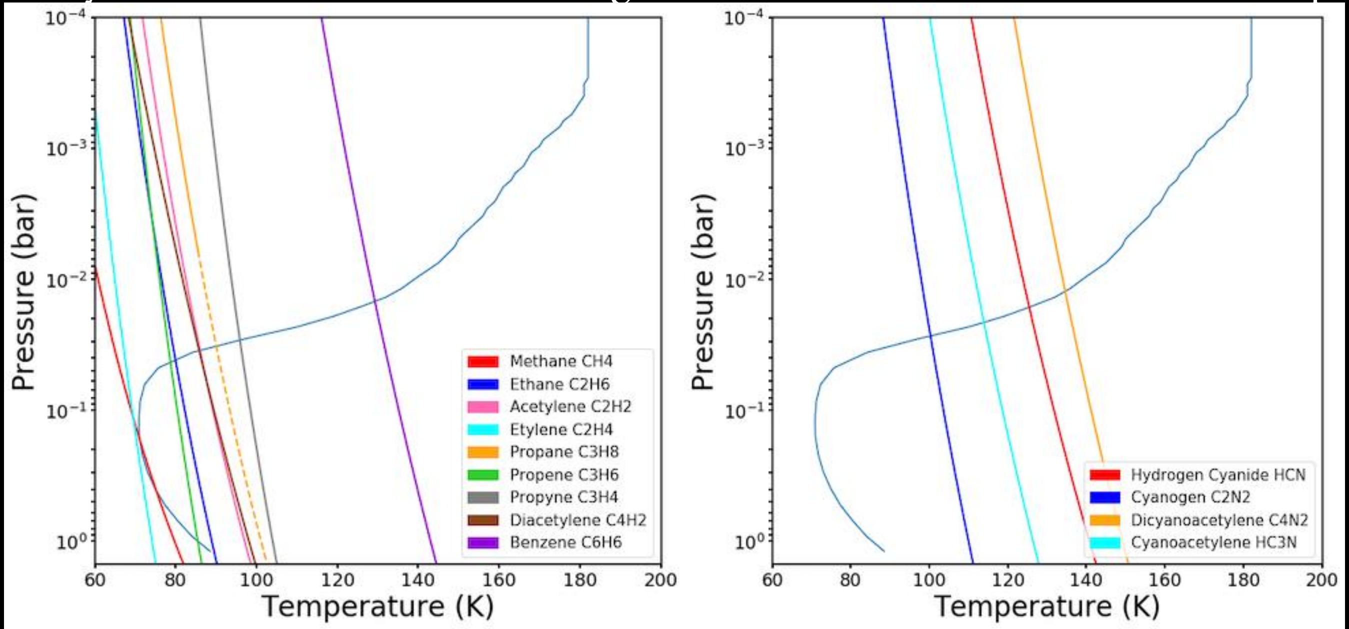
Possible organic condensates/clouds and contact angle

The condensation curves of observed species in Titan's atmosphere were plotted and compared to Titan's temperature profile to find possible organic condensates. The organic species are able to condense if their condensation curves intersect with the temperature profile. We then used the wetting theory to estimate the contact angles for cloud-haze and cloud-lake liquids.



--- Liquid-solid condensation curve — Gas-solid condensation curve

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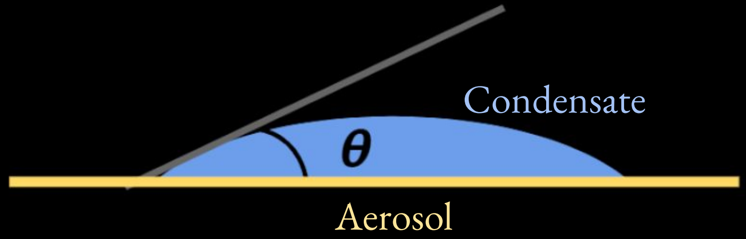
Titan's aerosols are suitable cloud seeds for most cloud species

	First method		Second method	
Species	Plasma Tholin (°)	UV Tholin (°)	Plasma Tholin (°)	UV Tholin (°)
CH_4	0	0	0	0
C_2H_2	19.4	11.5	0	0
C_2H_4	35.8	32.3	0	0
C_2H_6	25.1	19.7	0	0
C_3H_8 (liquid)	0	0	0	0
C_4H_2	0	0	0	0
C_6H_6	42.7	39.9	10.5	0
C_2N_2	31.5	27.4	0	0
HCN	0	0	0	0

This table includes the contact angles between organic condensates and the two types of Titan aerosol analogs, "tholins". The contact angles are mostly small ($\theta < 30°$). The aerosols on Titan should be good cloud seeds for most of the



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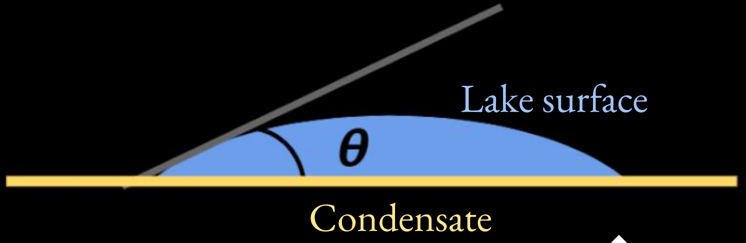
Cloud condensates are likely to sink into the lake

	First method		Second method	
Species	Pure nitrogen/ methane lakes (°)	Pure ethane lakes (°)	Pure nitrogen/methane lakes (°)	Pure ethane lakes (°)
C_2H_2	0	0	0	28.9
C_4H_2	0	0	0	0
C_6H_6	0	0	0	0
C_2N_2	0	0	0	0
HCN	0	0	0	28.4

This table includes the contact angles between organic condensates and the lake liquids. The contact angles are all small ($\boldsymbol{\theta}$ < 90°). The organic condensates are likely to sink into the lakes instead of floating on top because of the low contact angles.



Summary & Acknowledgement

✔ Titan's aerosols are easily wettable

✔ Titan's aerosols are likely good cloud seeds for most hydrocarbon and nitrile condensates on Titan

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✘ Organic condensates are unlikely to float on Titan's lakes (assuming they are denser than the lake liquids)

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