

Titan Through Time

Boulder, Colorado

August 10-12, 2021

Scientific Program

Day 1 – Tuesday August 10

9:00 – 9:30 am	Opening Remarks
	~~~~~ <i>Titan Astrobiology</i> ~~~~~
9:30 – 9:50	Rosaly Lopes – Invited Review Habitability of Hydrocarbon Worlds: Titan and Beyond
9:50 – 10:02	Alvaro Crósta ( <i>remote</i> ) Constraints of the Formation of Menrva Crater: Astrobiological implications
10:02 – 10:10	~~~~~ <i>Discussion &amp; Questions</i> ~~~~~
10:10 – 10:30	Break
	~~~~~ <i>Titan’s Subsurface – Oceans and Ice Shells</i> ~~~~~
10:30 – 10:42	Baptiste Journaux The thermodynamics of Titan’s abysses, Part I: Equation of State of water-ammonia solutions at conditions of Titan’s hydrosphere
10:42 – 10:54	Steven Vance (<i>remote</i>) The thermodynamics of Titan’s abysses, Part II: Using a new water ammonia equation of state to model the structure of Titan's hydrosphere
10:54 – 11:06	Evan Carnahan Dynamics of mixed clathrate-ice shells on icy ocean worlds
11:06 – 11:18	Gwendolyn Brouwer The Effect of Titan's Ice Shell Temperature on Pressure-Driven Eruptions
11:18 – 11:30	~~~~~ <i>Discussion & Questions</i> ~~~~~
	~~~~~ <i>Cryovolcanism and Cratering</i> ~~~~~
11:30 – 11:42	Rajani Dhingra ( <i>remote</i> ) Prospects of Cryovolcanic Columnar Joints on Titan
11:42 – 11:54	Shigeru Wakita ( <i>remote</i> ) The Effects of a Methane-Saturated Layer on the Morphology of Impact Craters on Titan
11:54 – 12:00	~~~~~ <i>Discussion &amp; Questions</i> ~~~~~
12:00 – 1:00	Lunch Break

1:00 – 2:00  
pm

Poster Session

~~~~~Titan's Varied Surface Terrains~~~~~

2:00 – 2:12

Anthony D. Maue (*remote*)
Rapid Fluvial Abrasion in the Titan Tumbler

2:12 – 2:24

Shannon MacKenzie
Prospects for Yardangs on Titan

2:24 – 2:36

Mathieu G. A. Lapotre (*remote*)
The Role of Seasonal Sediment Transport and Sintering in Shaping Titan's Landscapes

2:36 – 2:48

Sam Birch
Reconstructing River Flows on Earth and Titan

2:48 – 3:00

~~~~~Discussion & Questions~~~~~

~~~~~Past and Present Changes in the Polar Lakes~~~~~

3:00 – 3:12

Elainie Huncik
Past Polar Ice Cap Glaciation on Titan

3:12 – 3:24

Rose Palermo (*remote*)
Quantifying the relative influence of river incision, wave erosion, and scarp retreat on Titan's shoreline morphology

3:24 – 3:36

Michael Heslar (*remote*)
Physical Oceanography in the Coastal Zones of Titan's Punga Mare

3:36 – 3:45

~~~~~Discussion & Questions~~~~~

3:45 – 4:15

Break

~~~~~Hydrocarbon Mixtures on Titan's Surface~~~~~

4:15 – 4:35

Jordan Steckloff – Invited Review (*remote*)
Titan's Climate Cycle

4:35 – 4:47

Anna Engle
Mapping the Change in Temperature of the Methane-Ethane Freezing Points with the Addition of Nitrogen at Constant Vapor Pressure

4:47 – 4:59

Jennifer Hanley
The Effects of Propane on the Liquids of Titan

4:59 – 5:11

Kendra Farnsworth
An Experimental Study of Floating Liquid Droplets on the Surface of Liquid Hydrocarbons

5:11 – 5:30

~~~~~Discussion & Questions~~~~~

## Day 2 – Wednesday August 11

|                   |                                                                                                                                                                                                    |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9:00 – 9:30<br>am | Virtual participants questions/comments for Day 1 speakers<br><br>~~~~~ <i>Hazy Days in the Lab</i> ~~~~~                                                                                          |
| 9:30 – 9:50       | Xinting Yu – Invited Review<br>Laboratory Experiments on Understanding Atmospheric, Surface, and Interior Processes on Titan                                                                       |
| 9:50 – 10:02      | Jialin Li<br>A Cross-Laboratory Comparison Study of Titan Haze Analogs: Surface Energy                                                                                                             |
| 10:02 – 10:14     | Michel Nuevo<br>XANES Analysis of Laboratory Analogs of Titan Tholins                                                                                                                              |
| 10:14 – 10:26     | Ella Sciamma-O'Brien<br>New Results from the Ames Cosmic and Optical Constant Facilities: New Optical Constants of Titan Aerosol Analogs from Visible to Mid-IR                                    |
| 10:26 – 10:38     | Audrey Chatain ( <i>remote</i> )<br>Aerosols-plasma interaction in the ionosphere of Titan.                                                                                                        |
| 10:38 – 10:55     | ~~~~~ <i>Discussion &amp; Questions</i> ~~~~~                                                                                                                                                      |
| 10:55 – 11:15     | Break                                                                                                                                                                                              |
|                   | ~~~~~ <i>Lab II: Crystals and Condensation</i> ~~~~~                                                                                                                                               |
| 11:15 – 11:27     | Ellen Czaplinski<br>Characterizing the near-infrared spectral properties of acetylene-benzene and acetonitrile-acetylene co-crystals                                                               |
| 11:27 – 11:39     | David Dubois<br>Investigating the Condensation of Benzene (C ₆ H ₆ ) in Titan's South Polar Cloud System with a Combination of Laboratory, Observational, and Modeling Tools |
| 11:39 – 11:45     | ~~~~~ <i>Discussion &amp; Questions</i> ~~~~~                                                                                                                                                      |
| 11:45 – 1:00      | Poster Session                                                                                                                                                                                     |
| 12:30 – 1:30      | Lunch Break                                                                                                                                                                                        |

|                   |                                                                                                                                            |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
|                   | ~~~~~Titan's Atmosphere~~~~~                                                                                                               |
| 1:30 – 1:50<br>pm | Kelly E. Miller – Invited Review ( <i>remote</i> )<br>Review of Current Constraints on the Origin of Titan's Atmosphere                    |
| 1:50 – 2:02       | Michael Battalio<br>Titan's Annular Modes of Climate Variability Compared to Earth and Mars                                                |
| 2:02 – 2:14       | Eliot F. Young<br>Titan from Many Angles: Evidence for Changes in Methane and Aerosol Vertical Profiles                                    |
| 2:14 – 2:30       | ~~~~~Discussion & Questions~~~~~                                                                                                           |
| 2:30 – 2:50       | Break                                                                                                                                      |
|                   | ~~~~~Atmosphere II – Meteorology and Modeling~~~~~                                                                                         |
| 2:50 – 3:10       | Paul Corlies<br>Titan's Meteorology and Clouds: Past Observations and Future Forecasts                                                     |
| 3:10 – 3:22       | Aymeric Spiga ( <i>remote</i> )<br>Exploring Titan's atmospheric turbulence with Large-Eddy Simulations                                    |
| 3:22 – 3:34       | Jacob Shultis<br>Winter Warming of Titan's Polar Vortices                                                                                  |
| 3:34 – 3:46       | Juan M. Lora<br>Global influences of polar storms in simulations of Titan's climate                                                        |
| 3:46 – 4:05       | ~~~~~Discussion & Questions~~~~~                                                                                                           |
| 4:05 – 4:30       | Break                                                                                                                                      |
|                   | ~~~~~Looking There from Here~~~~~                                                                                                          |
| 4:30 – 4:50       | Conor Nixon – Invited Review ( <i>remote</i> )<br>Tangerine Dream: Observations of Titan from the Earth                                    |
| 4:50 – 5:02       | Emmanuel Garcia-Berrios ( <i>remote</i> )<br>Mapping the seasonal variability of gases from Titan's middle and upper atmosphere using ALMA |
| 5:02 – 5:14       | Martin Cordiner ( <i>remote</i> )<br>ALMA Observations of Rapid Temporal Variability in Titan's Upper-Atmospheric Winds                    |
| 5:14 – 5:30       | ~~~~~Discussion & Questions~~~~~                                                                                                           |

Workshop Dinner @ The Rayback Collective  
(meet there between 6:00 and 6:30 pm)

## Day 3 – Thursday August 12

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|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9:00 – 9:30<br>am | Virtual participants questions/comments for Day 2 speakers                                                                                                  |
| 9:30 – 9:45       | Cassini Titan PDS – Scott Edgington/Trina Ray ( <i>remote</i> )                                                                                             |
|                   | ~~~~~Anticipating Dragonfly~~~~~                                                                                                                            |
| 9:45 – 9:57       | Elizabeth Turtle<br>Dragonfly: In Situ Exploration of Titan's Organic Chemistry and Habitability                                                            |
| 9:57 – 10:09      | Jason W. Barnes<br>Mission Goals and Objectives: What Science is Dragonfly Going to Do?                                                                     |
| 10:09 – 10:21     | Kristin Sotzen<br>The Dragonfly Geophysics and Meteorology (DraGMet) Package: Exploring Titan’s Atmospheric, Interior, and Surface Processes                |
| 10:21 – 10:33     | Ralph Lorenz<br>Titan’s Schumann Resonance and Atmospheric Conductivity: A Critical Reassessment of Huygens Probe Observations, and Prospects for Dragonfly |
| 10:33 – 11:00     | Break                                                                                                                                                       |
| 11:00 – 12:15     | Dragonfly Panel                                                                                                                                             |
| 12:15 – 12:30     | Closing Remarks                                                                                                                                             |
| 12:30             | Meeting Adjourns                                                                                                                                            |

## Posters – Day 1

Poster Session 1:00 – 2:00 pm

|                                      |                                                                                                               |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Anezina Solomonidou<br>(remote)      | Compositional Mapping for Titan's Surface                                                                     |
| Arya Baad<br>(remote)                | Cyclopropenylidene                                                                                            |
| Charlton Blue Arm                    | Another look at Polaznik Macula: views from multiple angles to separate haze distribution from surface albedo |
| Christina McConville                 | Structural Investigation of High-Temperature Polymorphs of Propionitrile Ice                                  |
| Eleanor Isabella Serviss<br>(remote) | Open-Source Analysis of Titan's Radar-Bright Fluvial Features Using JMARS and Python                          |
| Léa Bonnefoy<br>(remote)             | Surface properties of the Selk crater region from SAR backscatter analysis                                    |
| Lena Heffern<br>(remote)             | Simulations for time-resolved nuclear spectroscopy on Titan                                                   |
| Paul Hayne                           | Surface Compositional Changes Following a Rainstorm on Titan: Constraints from Models and Cassini VIMS Data   |
| Ralph Lorenz                         | Mission Incredible: A Titan Sample Return Using In-Situ Propellants                                           |
| Shannon MacKenzie                    | DragonCam Science Objectives and Status Update                                                                |
| Sugata P. Tan<br>(remote)            | Modeling Capillary Condensation of Titan's Fluids in Small Pores                                              |

## Posters – Day 2

Poster Session 11:45 am – 1:00 pm

|                                     |                                                                                                                                                                               |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alexander Thelen<br>(remote)        | Mesospheric Temperatures and HCN Abundances in Titan's Northern Spring                                                                                                        |
| Brandon Park Coy<br>(remote)        | Compositional Analysis of Titan's Atmosphere Using Spitzer Infrared Spectrograph Data                                                                                         |
| Brendan Steffens<br>(remote)        | The Ongoing Search for Titan's n-Butane                                                                                                                                       |
| Darci Snowden<br>(remote)           | Magnetospheric O ⁺ Precipitation and Sputtering at Titan                                                                                                           |
| David Dubois                        | Negative Ion Chemistry in Titan's Upper Atmosphere: Modeling Efforts to Address Cassini CAPS-ELS Observations                                                                 |
| Hypatia Barry<br>(remote)           | Mapping the formation and dynamics of C ₂ H ₅ CN, C ₂ H ₃ CN, HCN, and C ₃ H ₈ from 2012 to 2017 with ALMA. |
| Lavender Elle Hanson<br>(remote)    | Simulating the seasonal evolution of polar stratospheric ice cloud                                                                                                            |
| Melissa Trainer<br>(remote)         | Development of the Dragonfly Mass Spectrometer (DRAMS) for Titan                                                                                                              |
| Nicholas Lombardo                   | Dynamical Simulations of Titan's Stratosphere using Observationally Derived Molecular Abundance and Aerosol Opacity                                                           |
| Richard Haythornthwaite<br>(remote) | Heavy Positive Ion Groups in Titan's Ionosphere: Cassini Plasma Spectrometer IBS Observations                                                                                 |
| Siobhan Light<br>(remote)           | Titan's Wind Field Around Equinox From eSMA Measurements                                                                                                                      |
| Steven M Kreyche                    | Profiling Titan's Hazy Atmospheric Limb with Cassini VIMS                                                                                                                     |