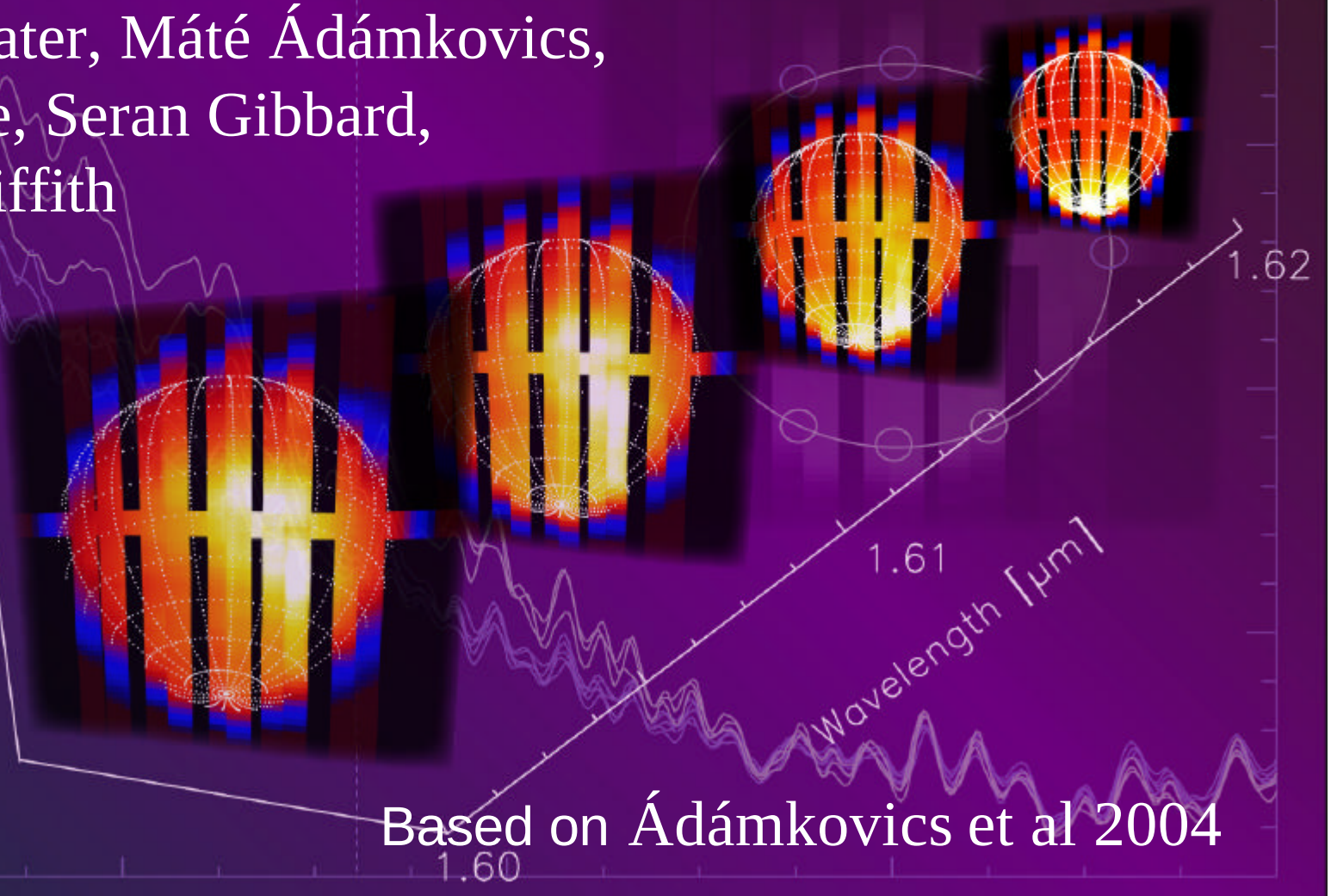
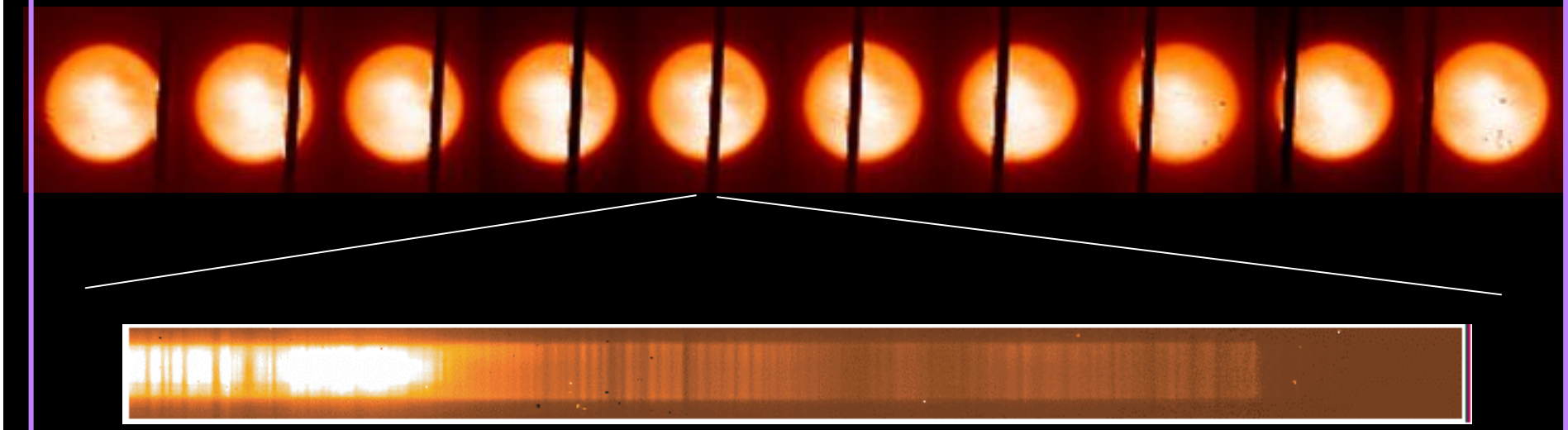
Flight through Titan's Atmosphere

Imke de Pater, Máté Ádámkovics,
Henry Roe, Seran Gibbard,
Caitlin Griffith



Based on Ádámkovics et al 2004

Spatially-resolved spectroscopy observations



Keck 2 NIRSPEC/AO, resolution $\lambda/\delta\lambda$ ~ 1500

3 Nights of data:19, 20 & 22 Feb 2001 UT

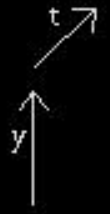
Spectrum 1.48 – 1.74 μm; Spatial resolution: <0.08”
(Adamkovics et al. 2004)

Spatially-resolved spectroscopy technique

Target Object

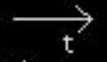
Slit Position

Object through slit



xyplane / individual spectrum

image cube 

image cube rotated
so that ytplane faces front 

http://wwwvims.lpl.arizona.edu/

Spatially-resolved spectroscopy observations

Keck 2 NIRSPEC/AO, res

3 Nights of data from 19,

Spectrum 1.48 – 1.74 μm;

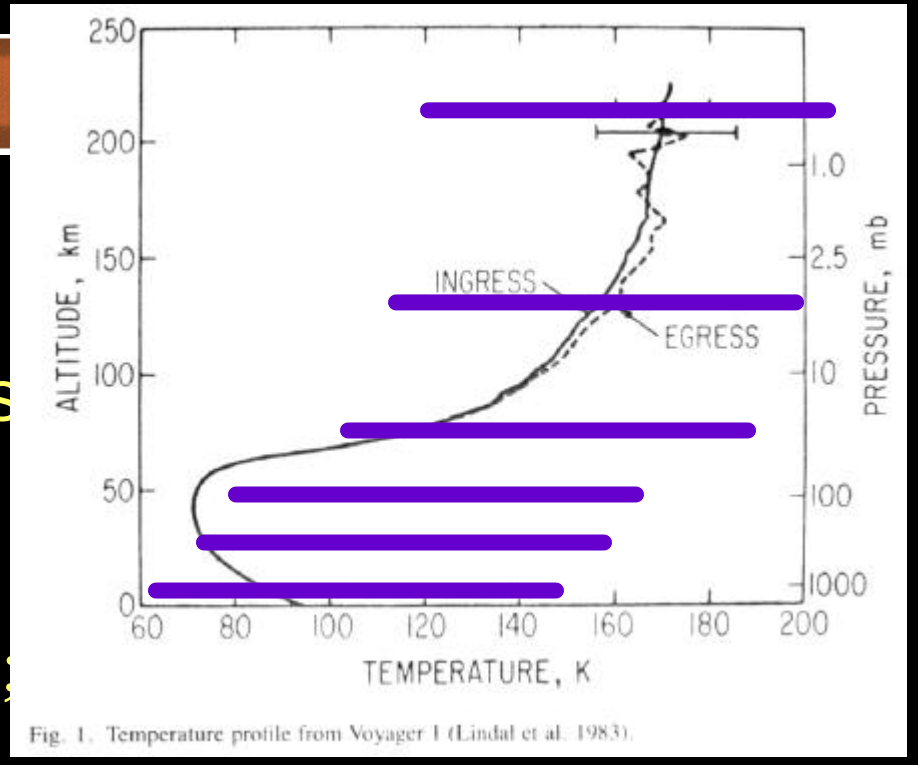
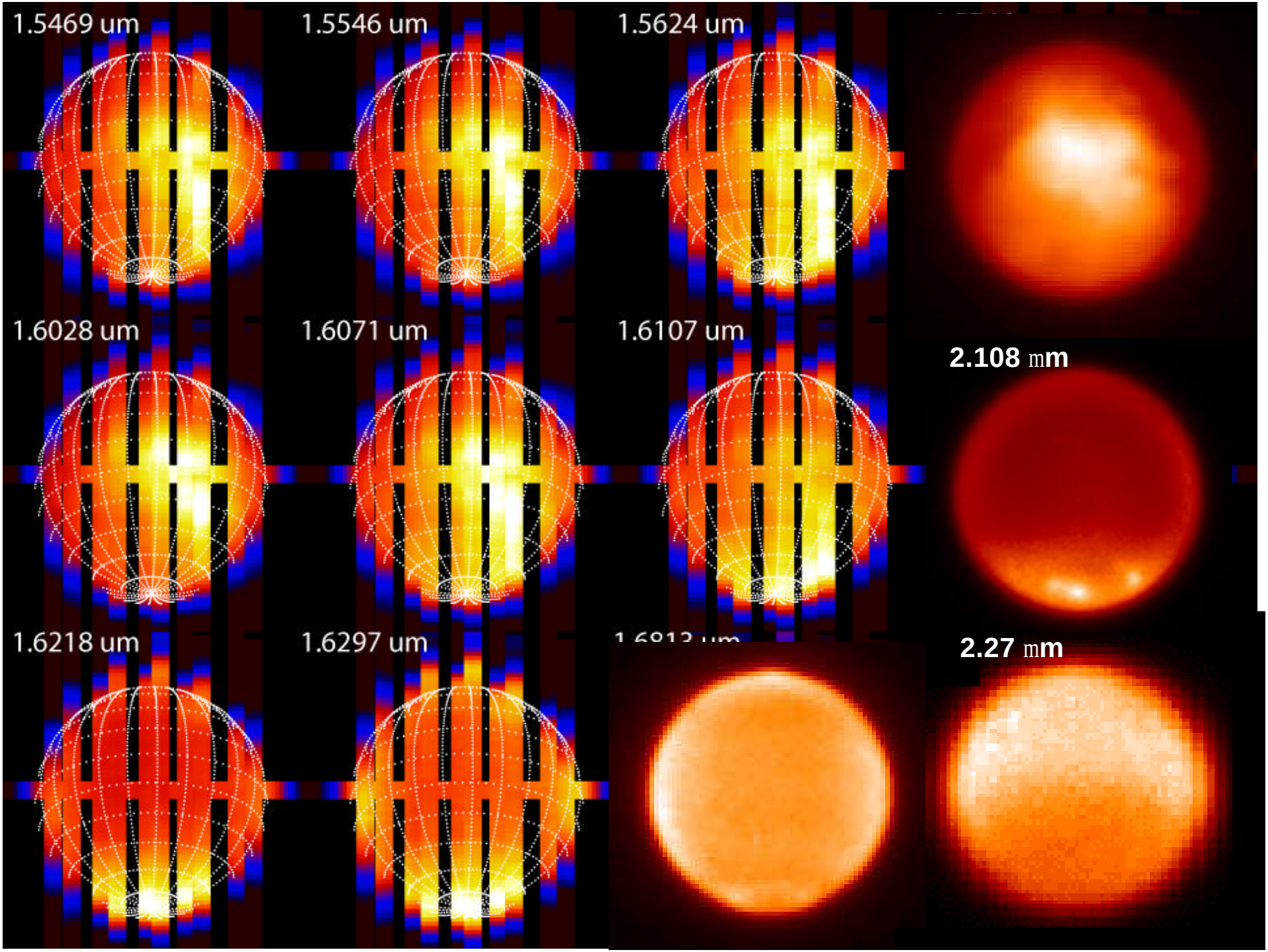
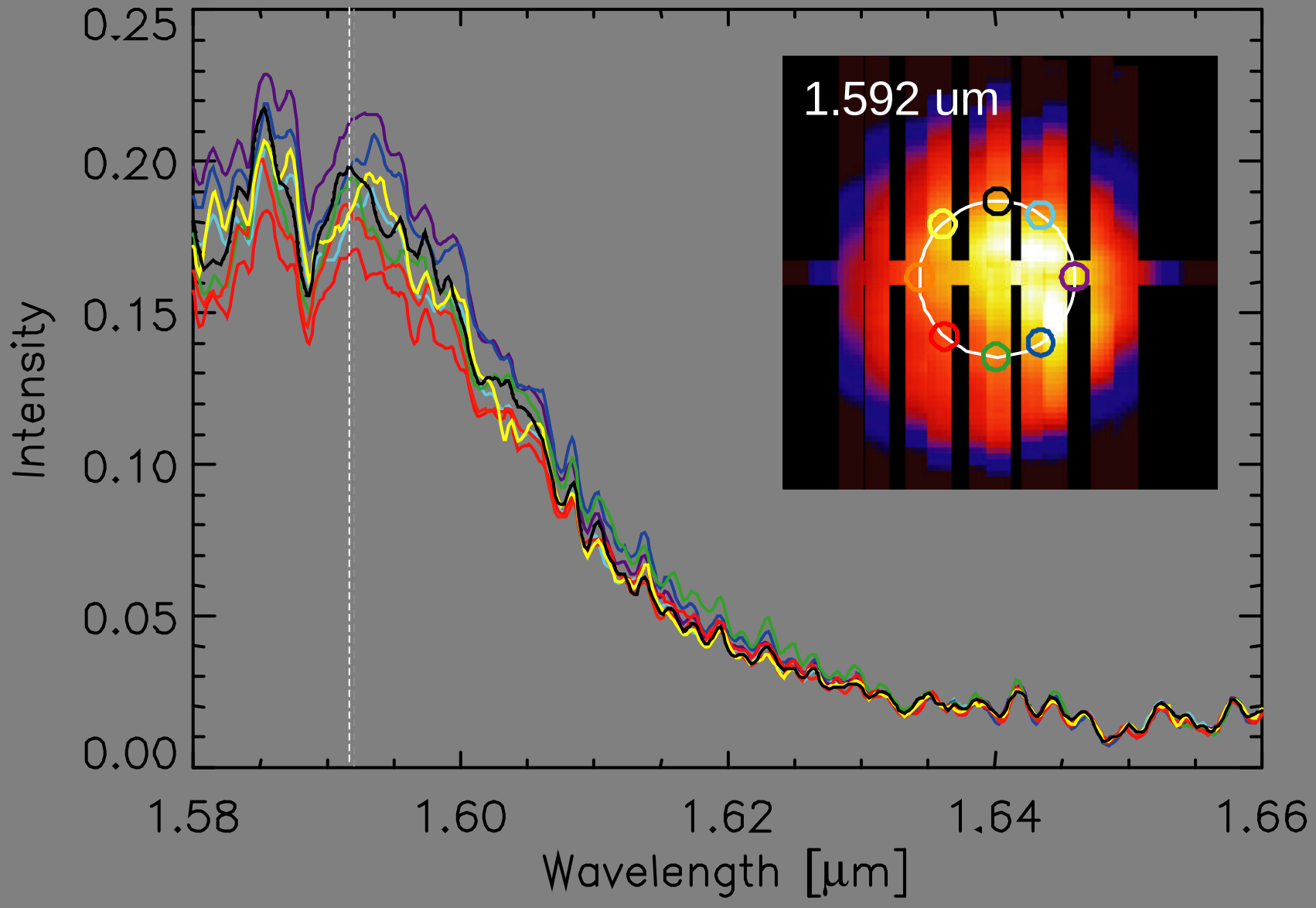


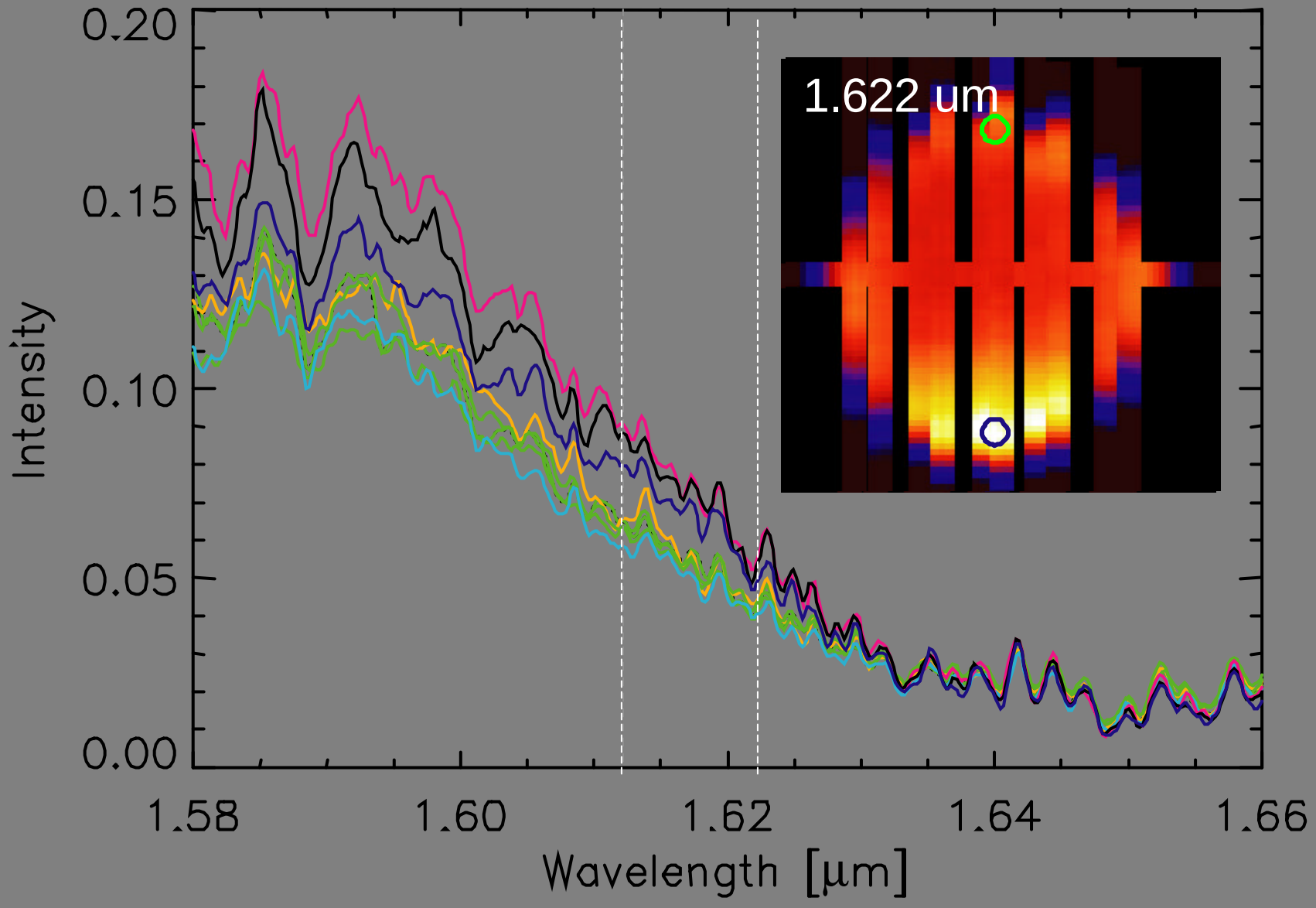
Fig. 1. Temperature profile from Voyager 1 (Lindal et al. 1983).


1.5469 um
1.5546 um
1.5624 um
1.6028 um
1.6071 um
1.6107 um
2.108 mm
1.6218 um
1.6297 um
2.27 mm

Spectra at different positions



Spectroscopic measurement of tropopause cirrus



Stratospheric haze profiles

Altitude (km)	Pressure (mbar)	Temp (K)	*25N* Optical Depth	*25N* Density (cm-3)	*80S* Optical Depth	*80S* Density (cm-3)
178.6	0.001	174	0.001	0.13	0.001	0.20
150.3	0.002	170	0.014	0.59	0.010	0.40
129.9	0.003	163	0.013	0.73	0.008	0.46
109.6	0.006	154	0.016	0.89	0.009	0.50
90.0	0.010	144	0.015	0.90	0.010	0.57
70.0	0.020	122	0.023	1.30	0.026	1.54
49.7	0.052	74.1	0.046	2.57	0.074	4.19
39.8	0.111	71.2	0.041	4.67	0.066	7.60
29.7	0.207	71.5	0.062	7.00	0.100	11.4
23.7	0.330	73.7	—	—	—	—
		Sum	0.21		0.29	

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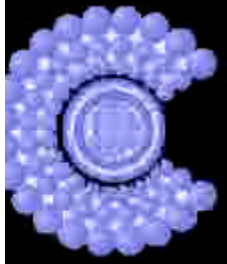


A Flight Through Titan's Atmosphere

by

Mate Adamkovics

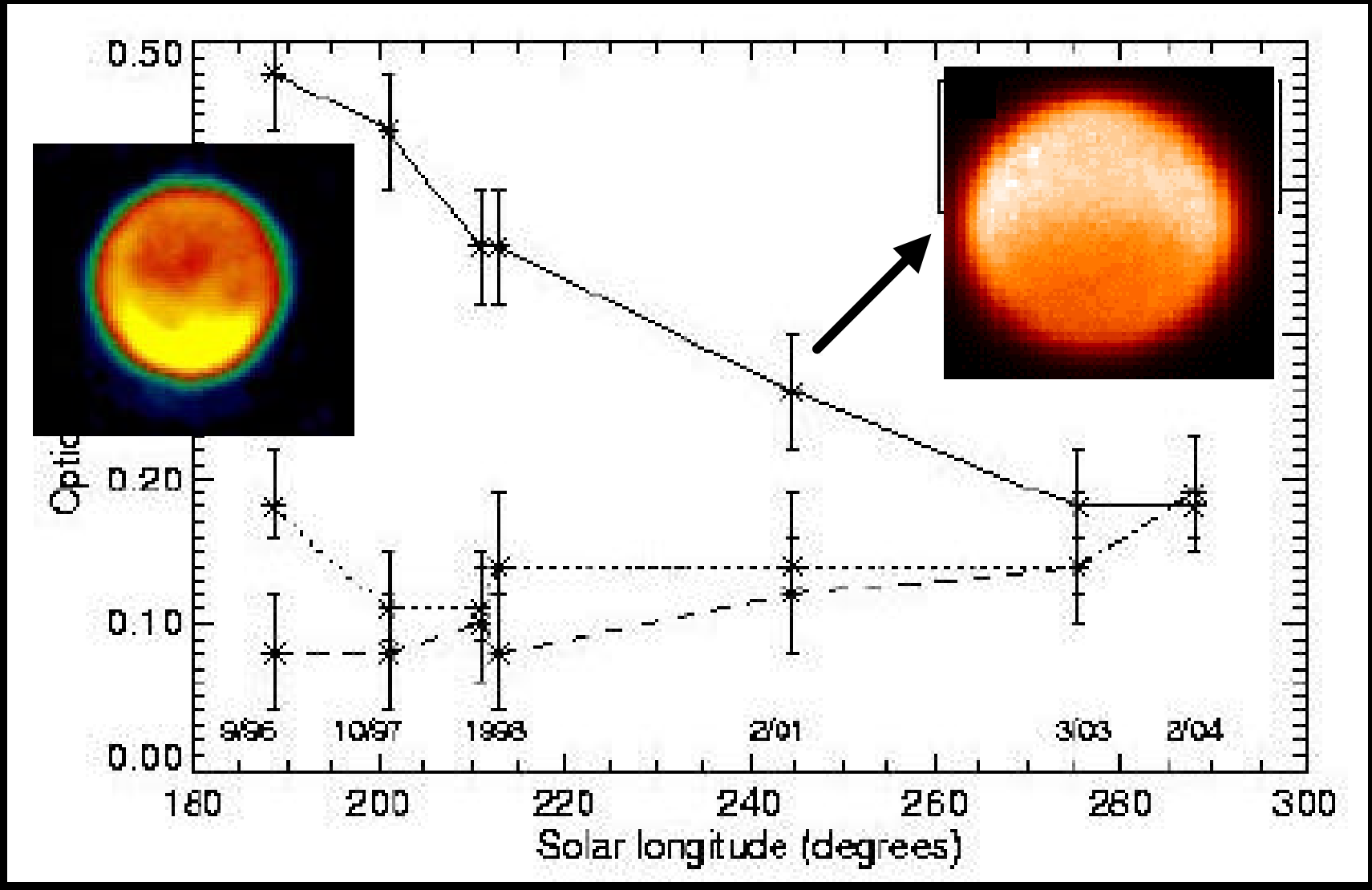
with

Imke de Pater, Henry G. Roe, Seran G. Gibbard, and Caitlin A. Griffith

Data source: W. M. Keck Observatory, 1.4 – 1.8 um NIRSPAO, February 2001

Scientific details: see Adamkovics et al., Geophysical Research Letters, 2004 (Titan Special Issue)

Haze optical depth integrated over lower ~200 km



Gibbard et al. 2004

Conclusions and Prospects for the Future

- Haze in stratosphere moved S → N (high → low altitudes)
- Tropopause cirrus disappeared in 2003
- Field integral spectrographs (OSIRIS on Keck, SPIFFI on VLT) powerful tools to monitor weather and haze distributions on Titan during and after Cassini era.
- Continued observations may reveal secret of cloud formation (will it stop in the South when temperature drops; will it start in the North if/when tropopause cirrus appears?)