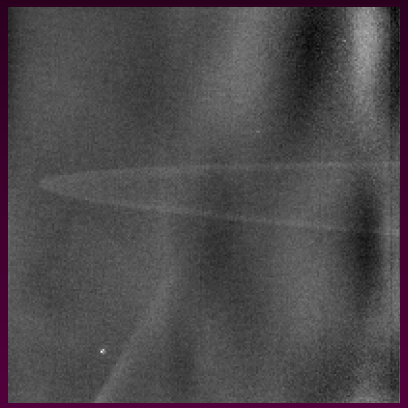
Cassini Imaging Observations of Jupiter's Rings



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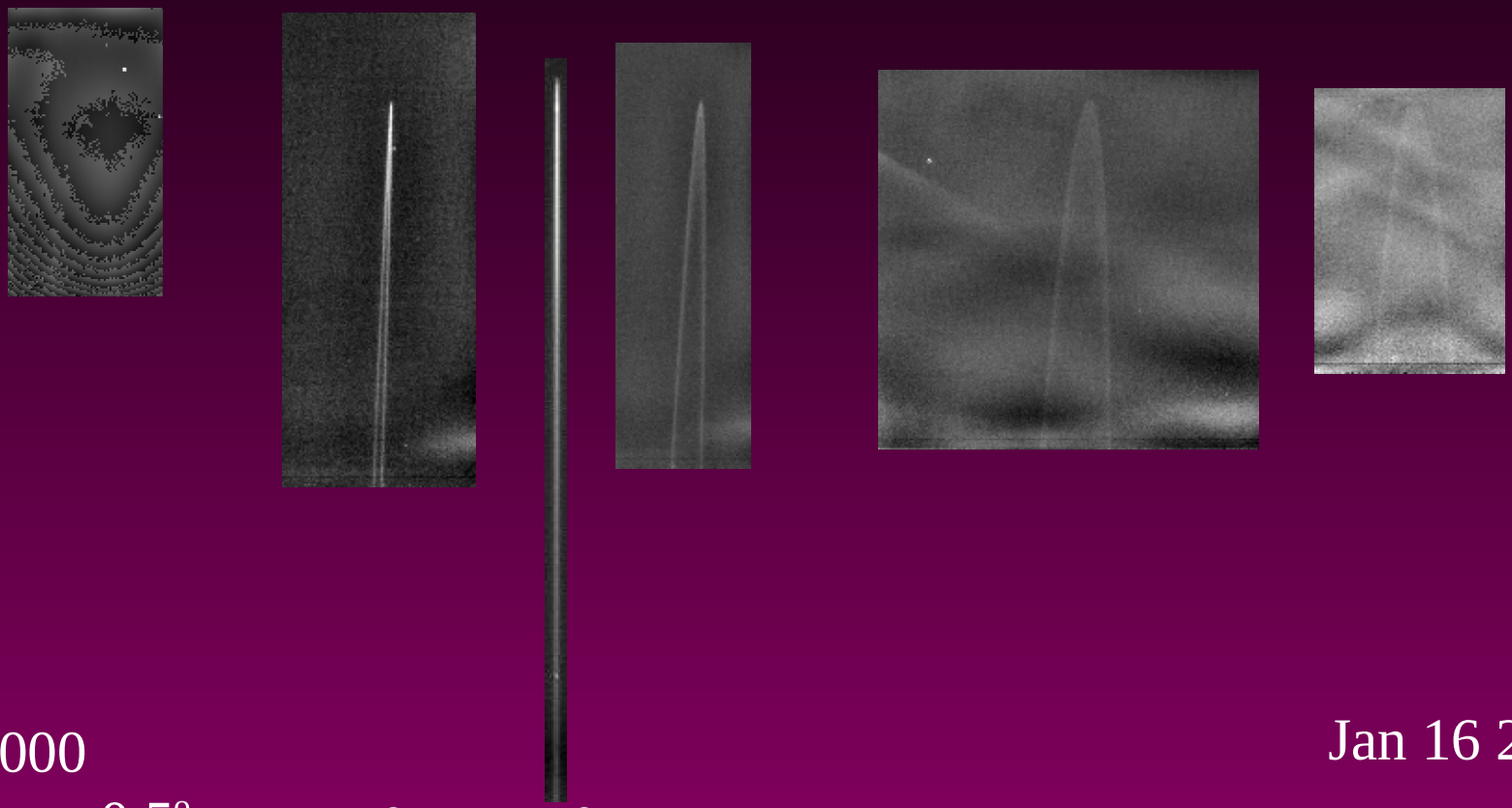
L. Dones, R. West, J. Burns, C. Murray, A. Brahic

29−Nov−2001
DPS / New Orleans

Observation Overview

- 800 images
  - Two 40−hour, 300−frame movie sequences;
  - Phase curve: 9 filters, 3 polarizers, $\alpha = 0^{o} - 120^{o}$
  - Ring plane crossing observations
  - Gossamer ring search
- Resolution 60−100 km/pix
- Range 140−280 R_J (Voyager C/A: 5 R_J)
- Latitude 3^{o} above/below equator

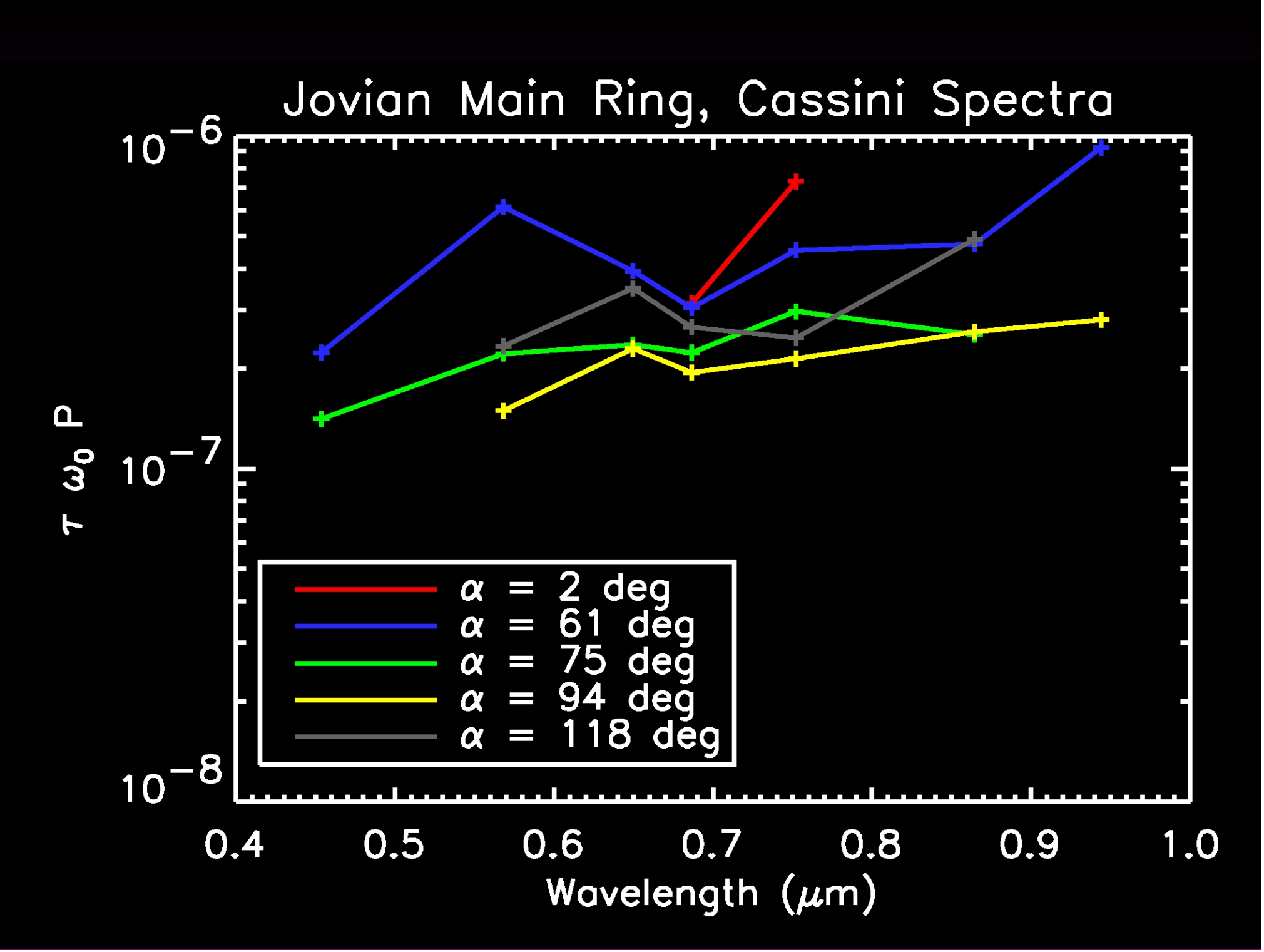
Through the Encounter...

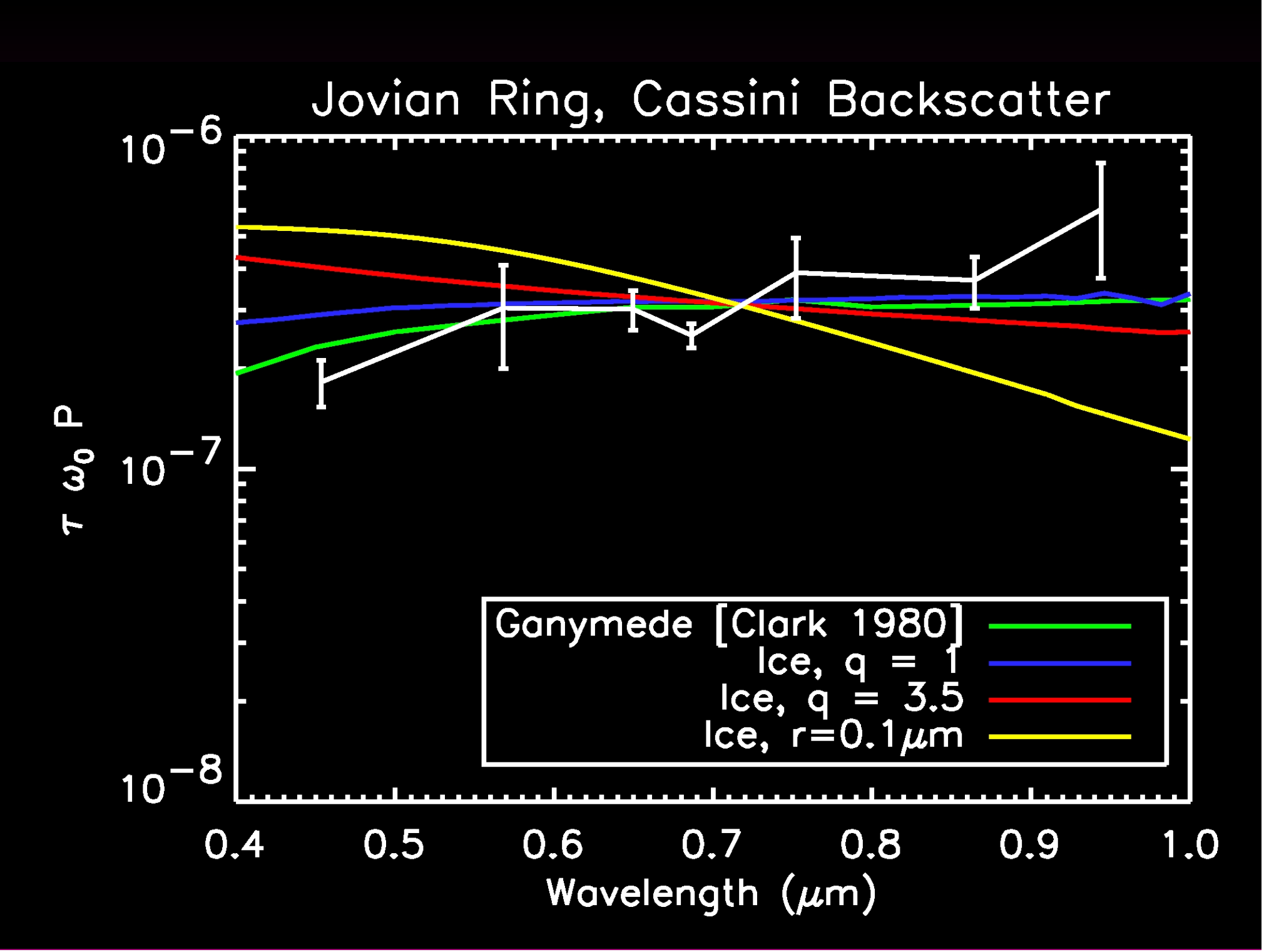


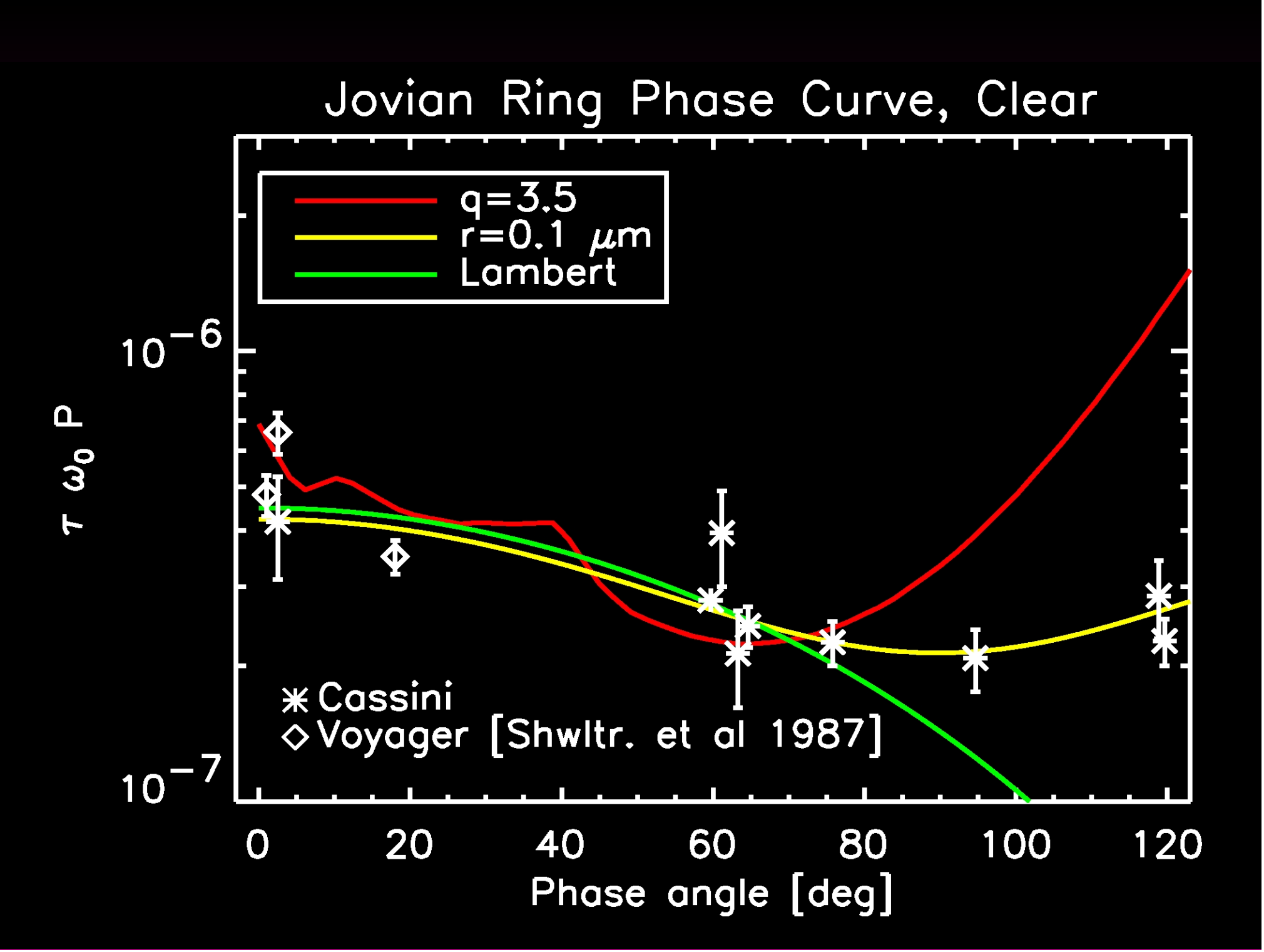
Dec 12 2000

Jan 16 2001

α=0.5^o 60^o 64^o 75^o 94^o 120^o


Jovian Main Ring, Cassini Spectra
10^{-6}
10^{-7}
10^{-8}
$\tau\ \omega_0\ P$
α = 2 deg
α = 61 deg
α = 75 deg
α = 94 deg
α = 118 deg
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Wavelength (μm)


Jovian Ring, Cassini Backscatter
10^{-6}
10^{-7}
10^{-8}
$\tau\ \omega_0\ P$
Ganymede [Clark 1980]
Ice, q = 1
Ice, q = 3.5
Ice, r=0.1μm
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Wavelength (μm)


Jovian Ring Phase Curve, Clear
q=3.5
r=0.1 μm
Lambert
10^-6
10^-7
τ ω0 P
Cassini
Voyager [Shwltr. et al 1987]
0
20
40
60
80
100
120
Phase angle [deg]

Photometry

- Spectrum
  - Broadly red from 0.4 − 1 μm
  - Fits spectrum of Ganymede−like surface
  - Fits spectrum of r ~ 10 μm Mie scatterers
- Phase Curve
  - Reasonably flat from 0 − 120 deg
  - Consistent with macroscopic & sub−μm grain
    - BUT: Sub−μm grains ruled out by bright forward−scatter photometry
- Optical depth looks stable since Voyager

Photometry

- Ring can be fit by combination of red, macroscopic particles with sub−μm component
- Generally consistent with models of Showalter et al 1987; Brooks et al 2001

Fainter Rings

- Halo − not detected
- Gossamer rings − not detected
- New rings − none detected

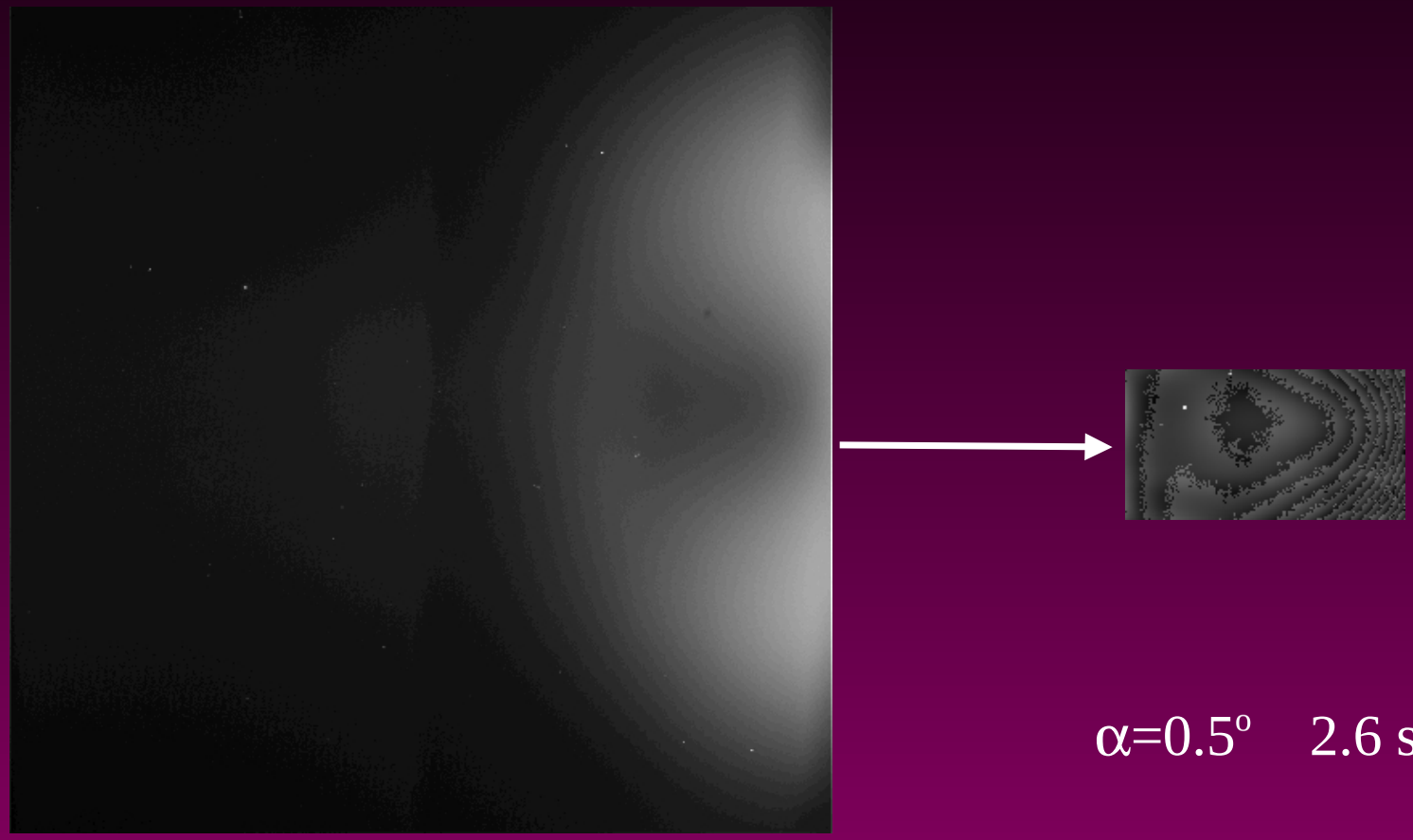
Why?

- Short exposures (< 5 s)
- Large distances (> 140 R_J)
- Edge−on geometries (< 3 deg)

TBD

- Still to be done with Cassini Jupiter ring data:
  - Polarimetry (P. Estrada / J. Burns)
  - Ring thickness
    - Probably insufficient spatial resolution
  - Azimuthal clumps
  - Integrate into evolutionary model (e.g., Brooks et al)

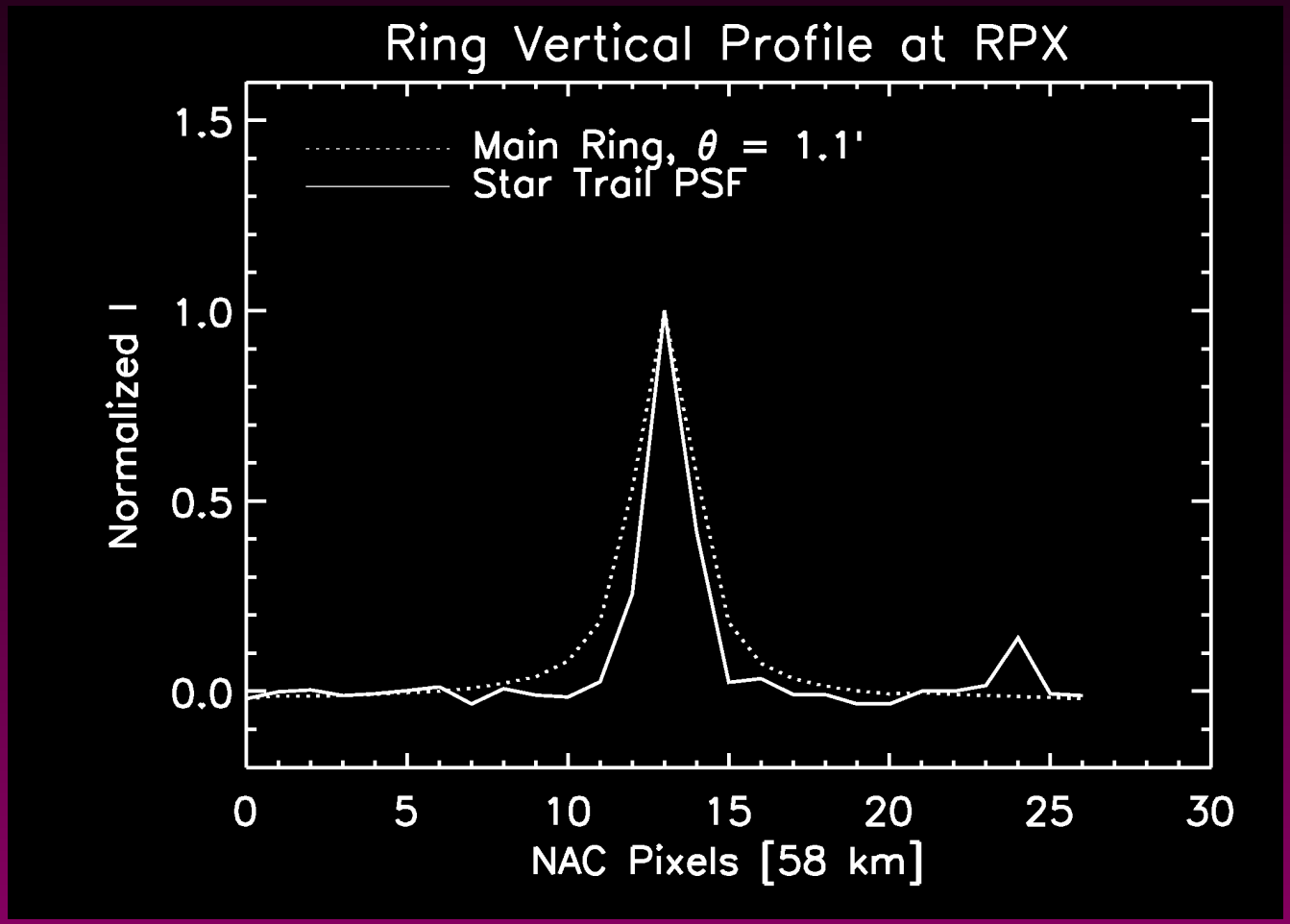
Image Processing



α=0.5° 2.6 s

Analysis is hindered by scattered light and short exposures

Ring Vertical Profile



Profile tentatively suggests z < 300 km