

# Asteroid 2 Pallas Physical Properties from Near-Infrared High-Angular Resolution Imagery

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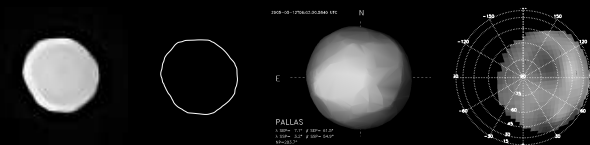
<sup>3</sup>University of Helsinki

<sup>4</sup>IMCCE, Observatoire de Paris

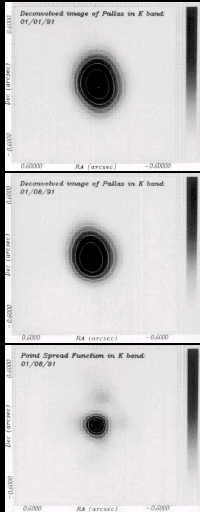
<sup>5</sup>Southwest Research Institute

<sup>6</sup>Keck Observatory

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# Asteroid 2 Pallas



*Saint-Pé et al., Icarus, 1993*

- ▷ Discovered by H. Olbers, 1802
  - Second Discovered Asteroid
  - Third Largest Asteroid
  - Third Most Massive
  - NIR Spectrum Similar to Ceres' one
  
- ▷ Almost **NOT** studied
  - Half Studies Joint with Ceres
  - Only Mass Measurement since 1996

# Observations



- NIRC2 on Keck II Observatory
  - 2003 opposition
  - $\phi \sim .44''$
  - 10 m mirror
  - 1/2 hour, 1 night



- NACO on Yepun/VLT Observatory
  - 2005 opposition
  - $\phi > .44''$
  - 8.2 m mirror
  - 4 hours, 5 nights

# Pallas at Near-Infrared Wavelengths

K-band



0,-70

K-band



130,63

K-band



165,63

K-band



280,63

H-band



3,63

H-band



133,63

H-band



167,63

H-band



300,63

J-band



5,63



3-D Model

J-band



170,63

K-band



Edge Detection

## Comparison with Lightcurve



Contour Extraction  
▷ Wavelet Analysis

# Comparison with Lightcurve



Contour Extraction

▷ Wavelet Analysis

Model Adjustment

▷ 30.12: *M. Kaasalainen*



# Comparison with Lightcurve



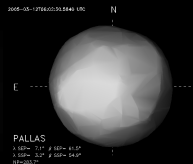
Contour Extraction  
▷ Wavelet Analysis

Model Adjustment

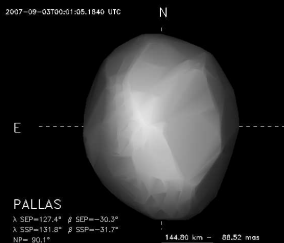
▷ 30.12: M. Kaasalainen



Shape Model as Reference  
▷ Volume, Mapping...



# Pallas Full Physical Model



## ▷ Tri-Axial Values

- $a = 278 \pm 5$  km
- $b = 214 \pm 4$  km
- $c = 209 \pm 4$  km

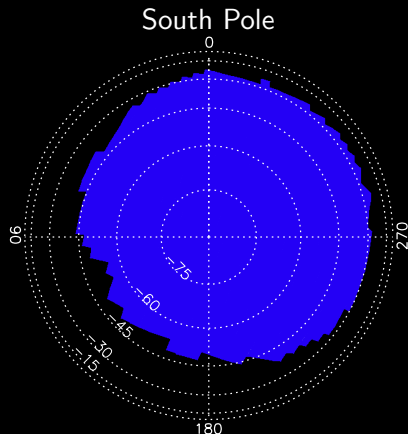
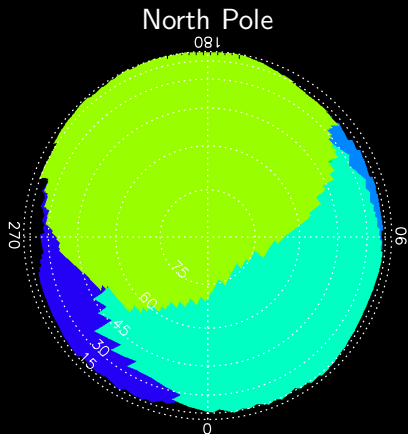
## ▷ Pole Solution

- $P_s = 7.8132$  h
- Ecliptic J2000.0  $\lambda = 34^\circ \pm 5^\circ$   
 $\beta = -11^\circ \pm 5^\circ$

## ▷ Bulk Density

- $M = 2.32 \pm 0.06 \times 10^{20}$  kg
- $V = 61.9 \pm 2.9 \times 10^{15}$  m<sup>3</sup>
- $\rho = 3760 \pm 270$  kg.m<sup>-3</sup>

# Spatial Coverage



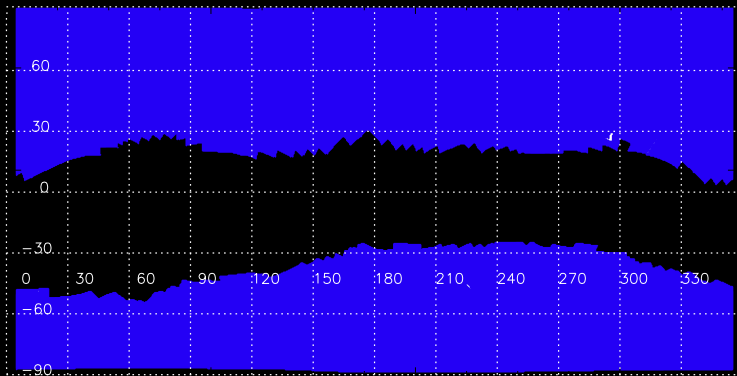
2005 Feb 01  
2005 Mar 11

2005 Mar 12  
2005 May 8

2005 May 9

2003 Oct 10

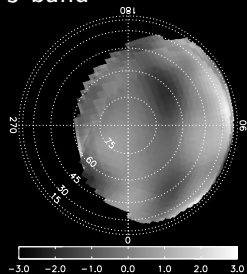
# Spatial Coverage



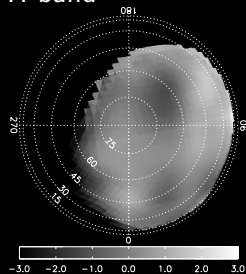
■ Total Coverage

# Surface Mapping

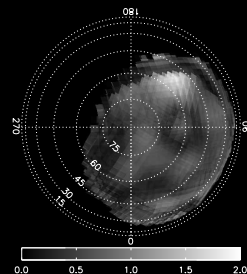
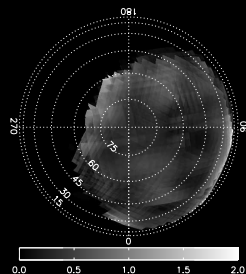
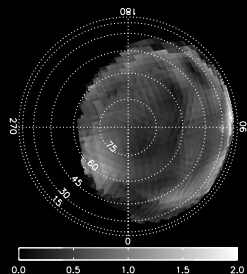
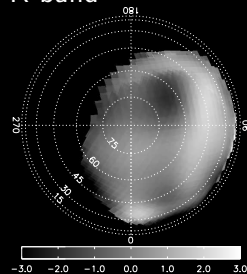
## J band



## H band



## K band



## Summary

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- ▷ Spin Vector Determination
  - Unambiguous Pole Solution
  
- ▷ Size Measurement & Shape Modelisation
  - Dimensions Smaller than Previously Measured
  - Density Higher
  
- ▷ Surface Analysis... *underwork!*
  - Various Night Combination
  - Spectral Behavior of Major Albedo Features