

Imaging Active Stellar Surfaces with Photometric, Spectroscopic, and Interferometric Observations

Collaborators:

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Stockholm University
Yale University, YCAA Fellow

Cool Stars 20
31 July 2018

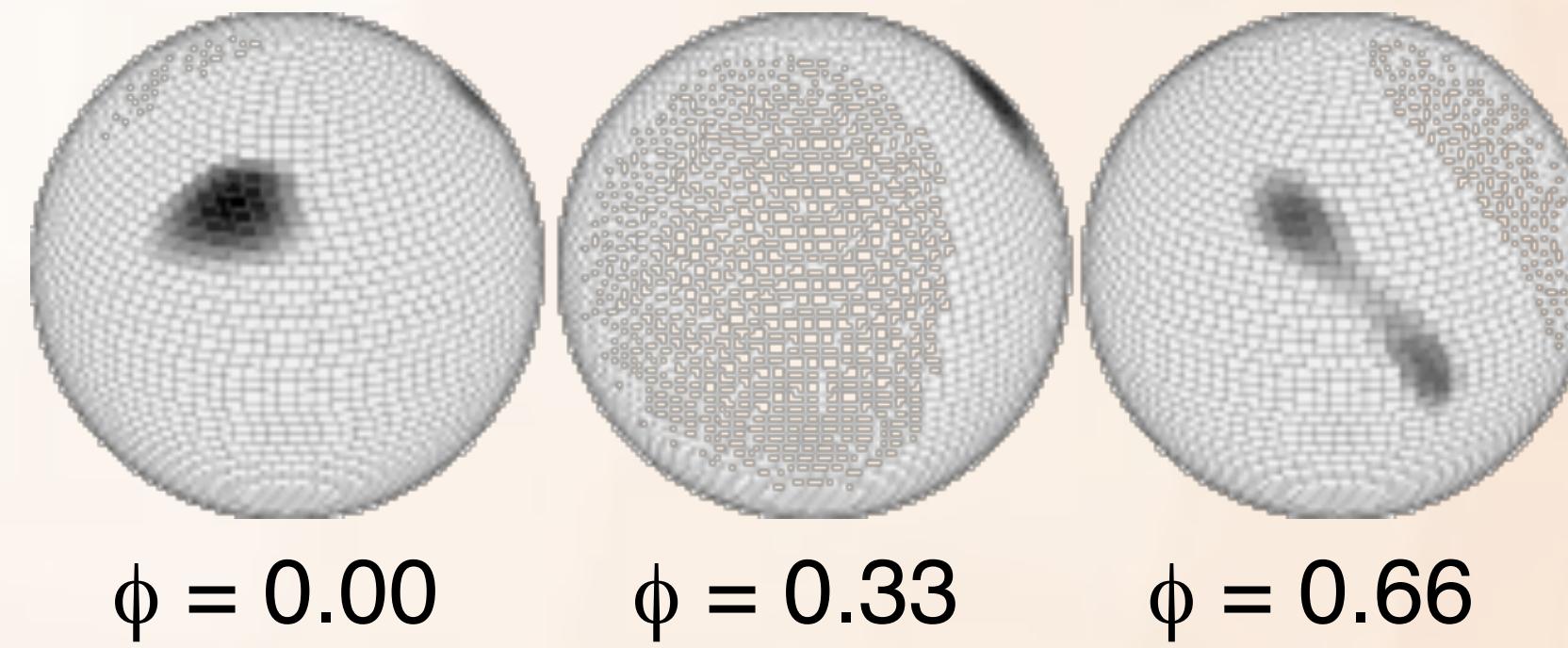
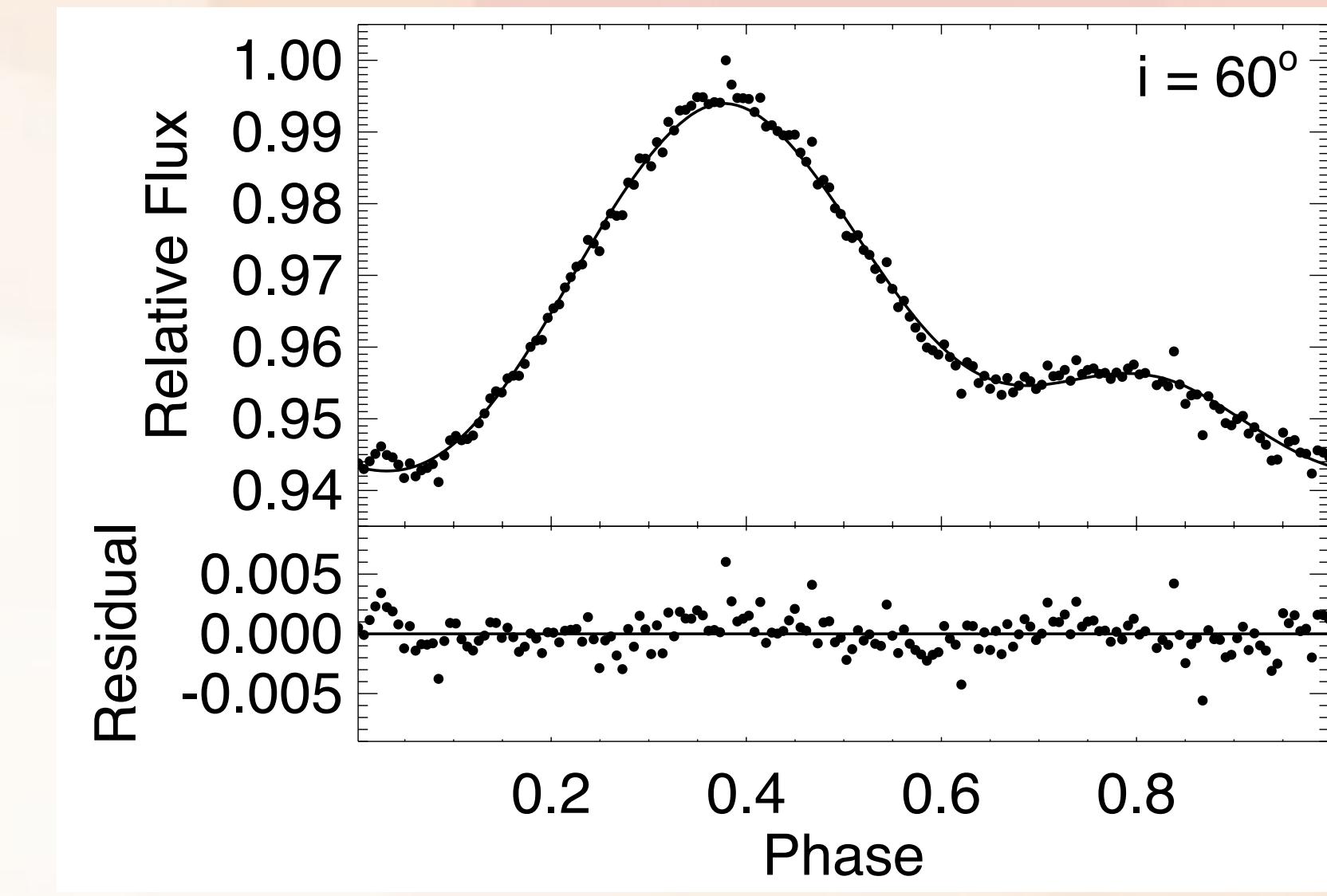
RS Canum Venaticorum Stars

- Binary with giant primary and main sequence secondary
- Many with short orbital periods and tidally-locked
- Show photometric and Ca II H&K variability



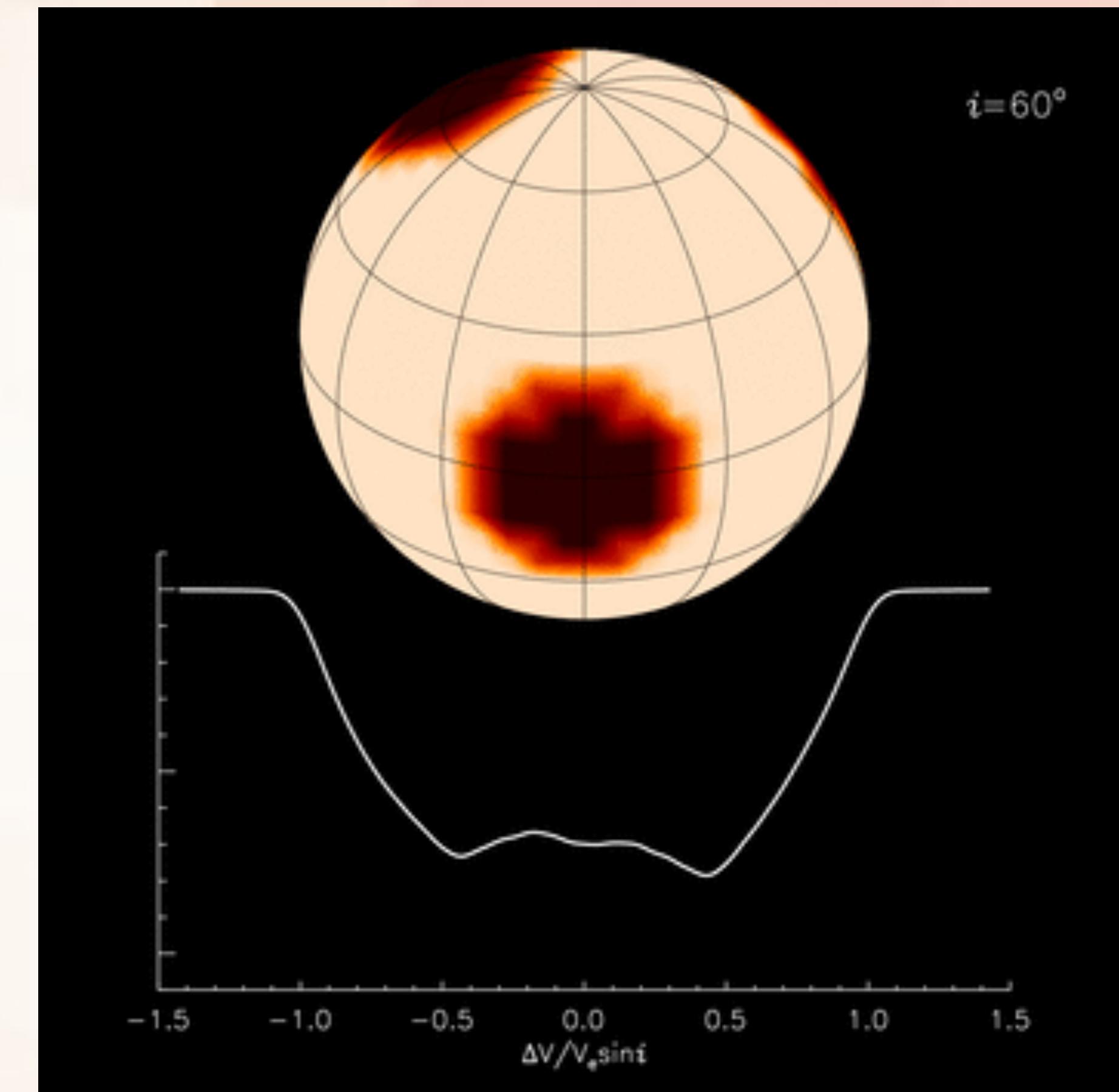
Light-curve Inversion

- Spots rotate in and out of view causing variability
- Advantages
 - Applied to any star
 - Constrains spot longitude
 - Requires little data
- Disadvantages
 - Poor latitude constraints
 - No inclination constraints
 - Only detected rotation modulation



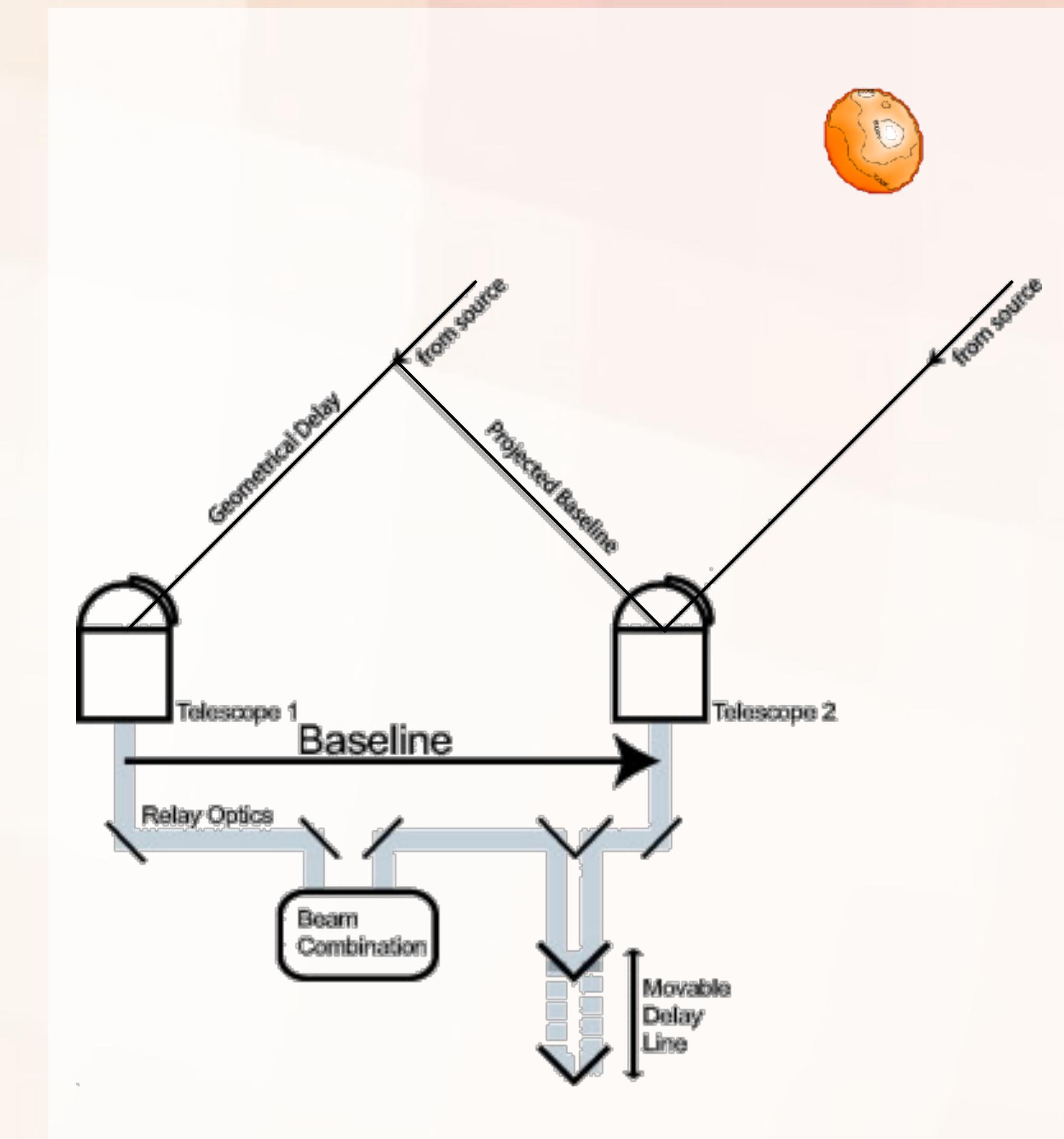
Doppler Imaging

- Spots rotate in and out of view seen as distortions in absorption lines
- Advantages
 - Constrains spot latitude
 - Constrains spot longitude
- Disadvantages
 - Requires high signal-to-noise, high-resolution spectra
 - Requires good phase coverage
 - Applied to rapidly-rotating stars

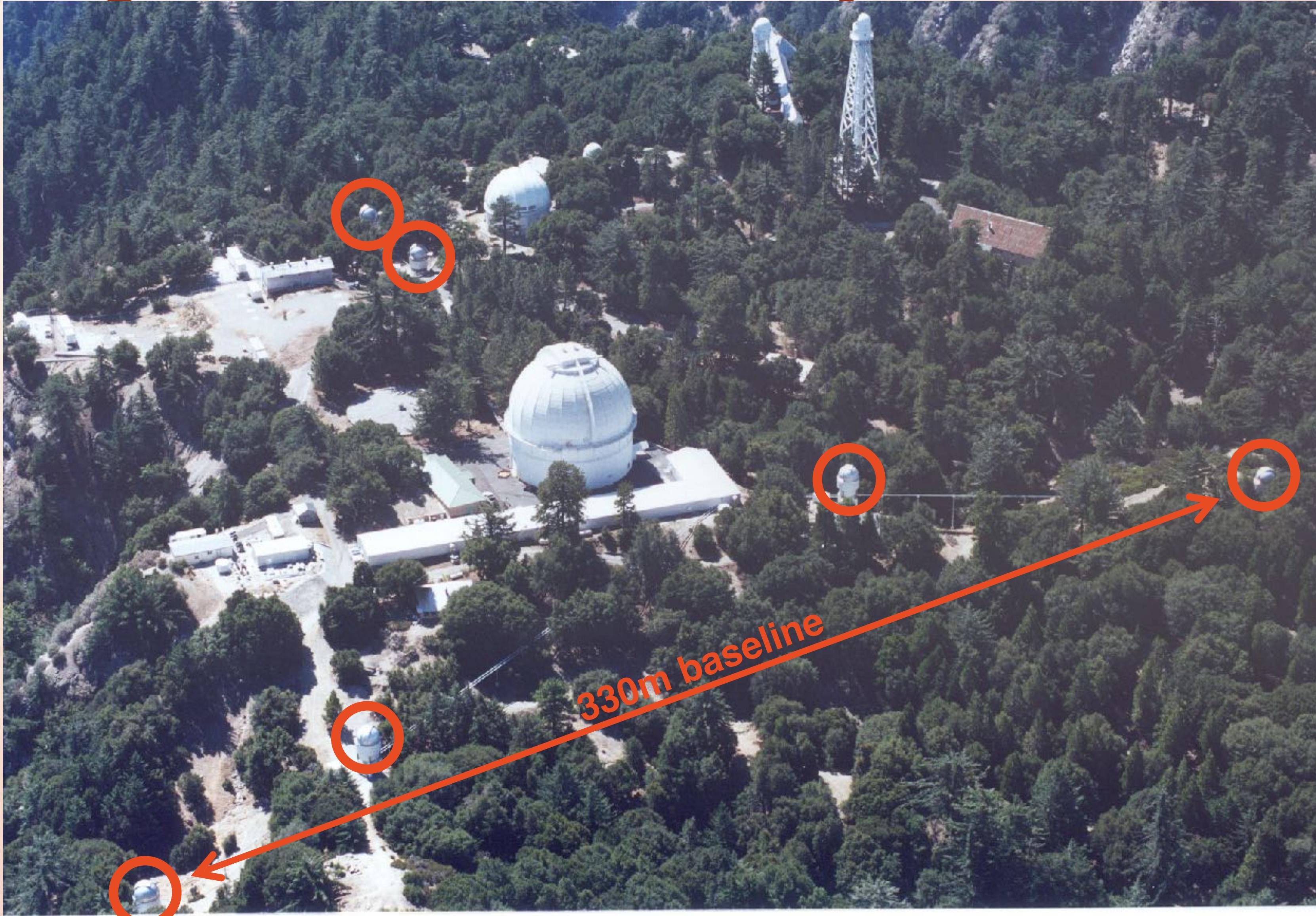


Interferometric Imaging

- Spots imaged directly as appear on surface
- Advantages
 - Determines orientation on sky, inclination
 - Accurately maps spot location
 - No fundamental limit to resolution
- Disadvantages
 - Requires large stars
 - Requires bright stars
 - Limited baseline lengths

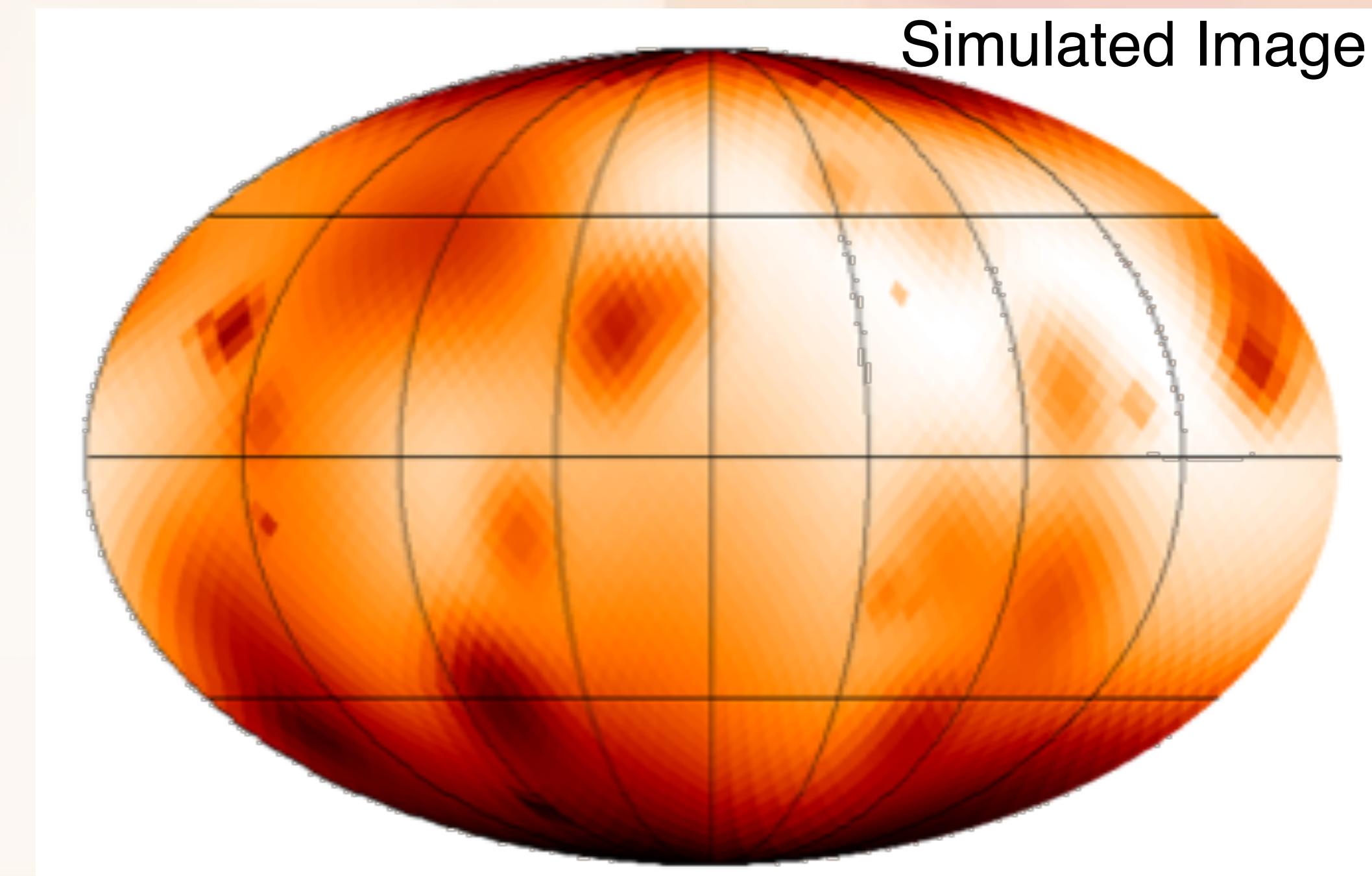


Georgia State University's CHARA Array



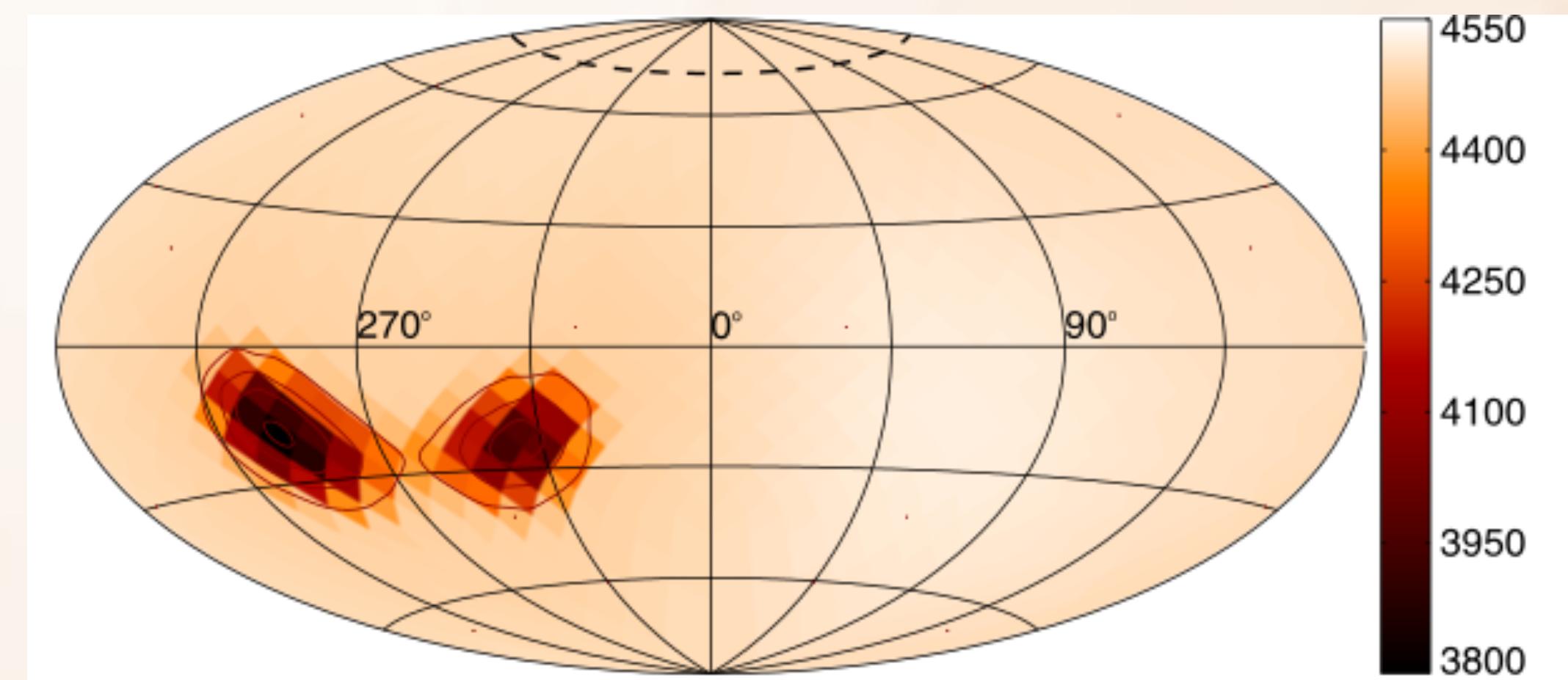
SURFING: SURFace imagING

- Each pixel on the surface of a rotating star can be changed to fit multi-epoch data
- More robust than imaging single snapshots
- Analogous to technique used in Doppler imaging



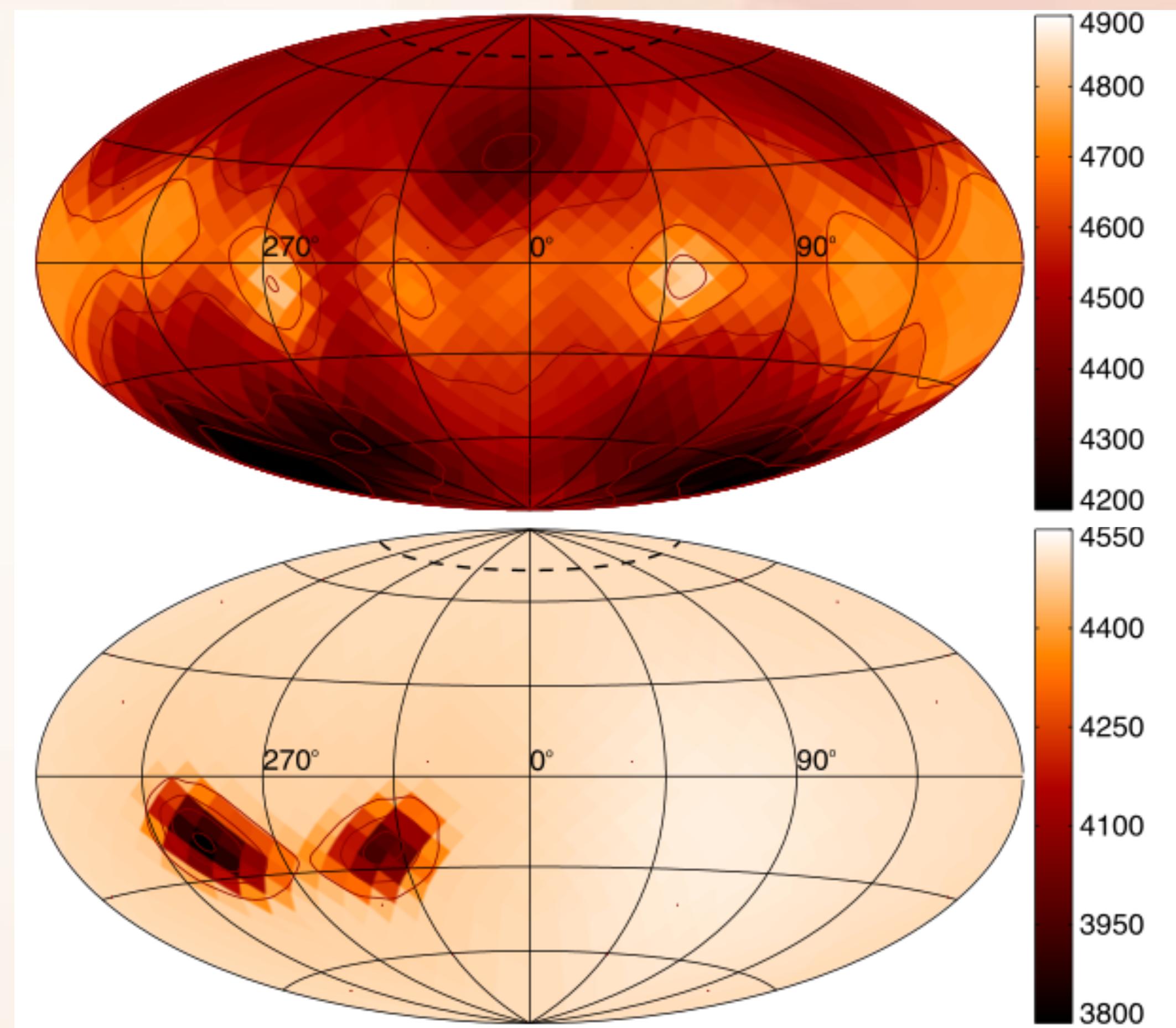
Starspots of σ Gem

2011 Imaging



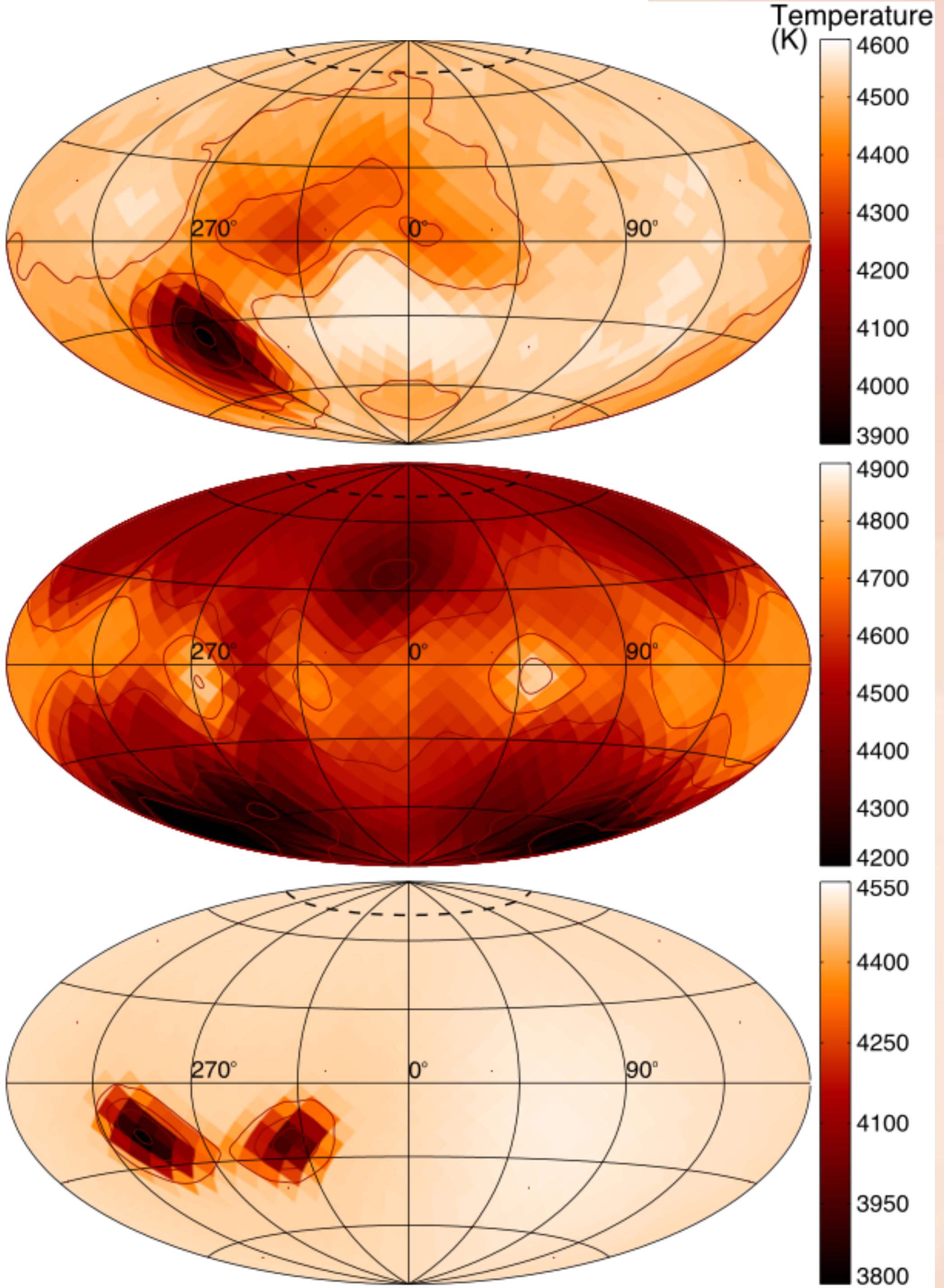
Starspots of σ Gem

2011 Imaging

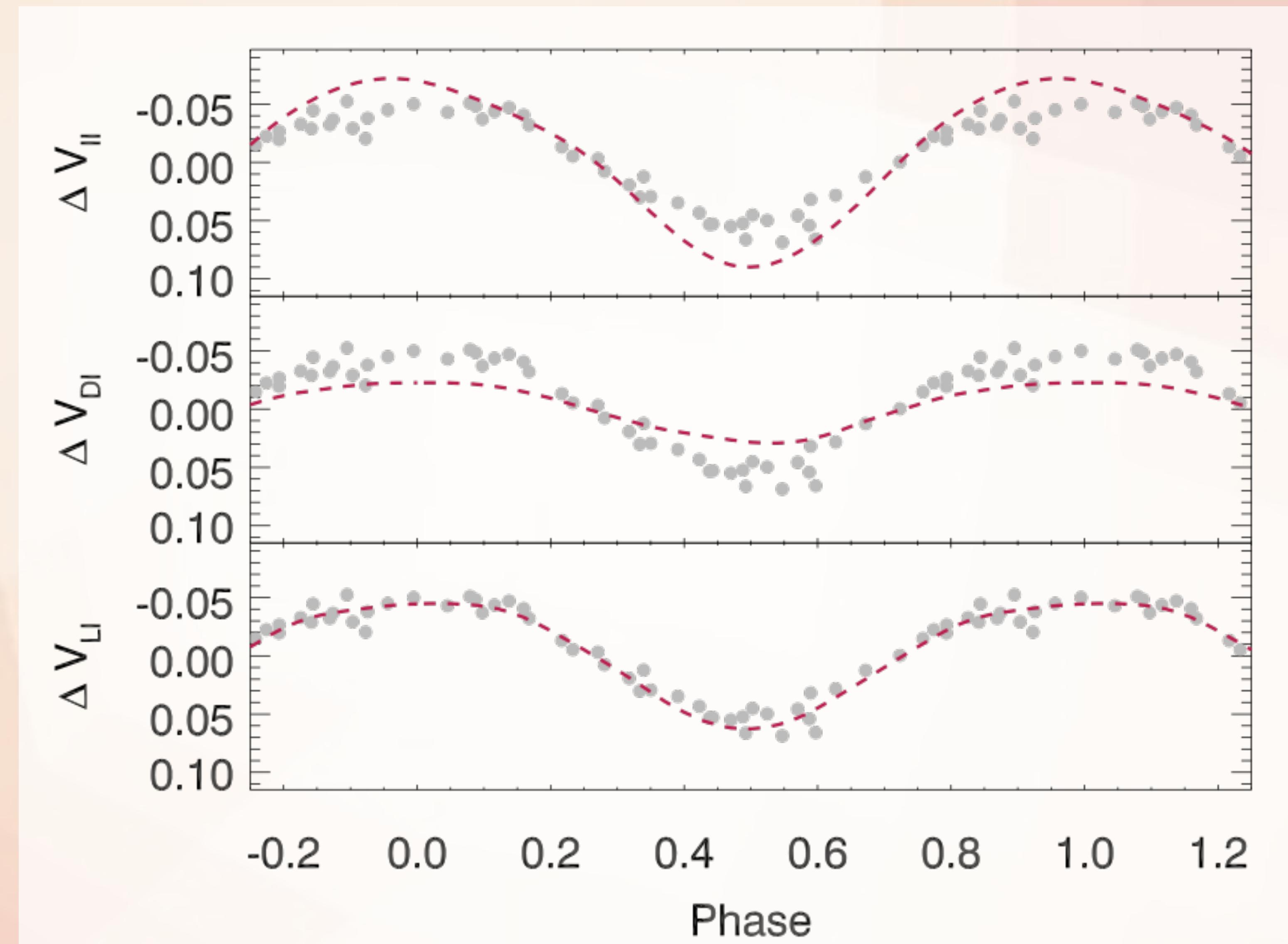


Starspots of σ Gem

2011 Imaging

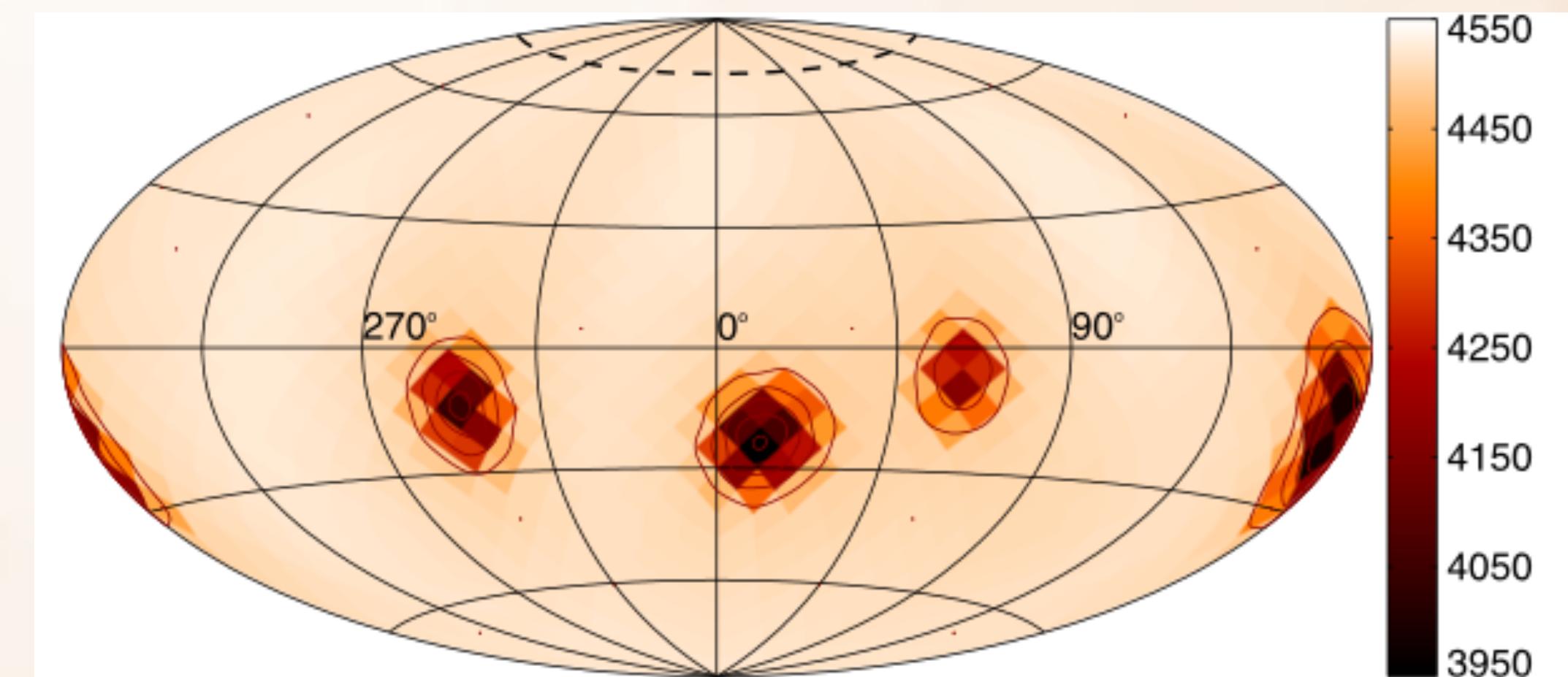


2011 Starspots of σ Gem



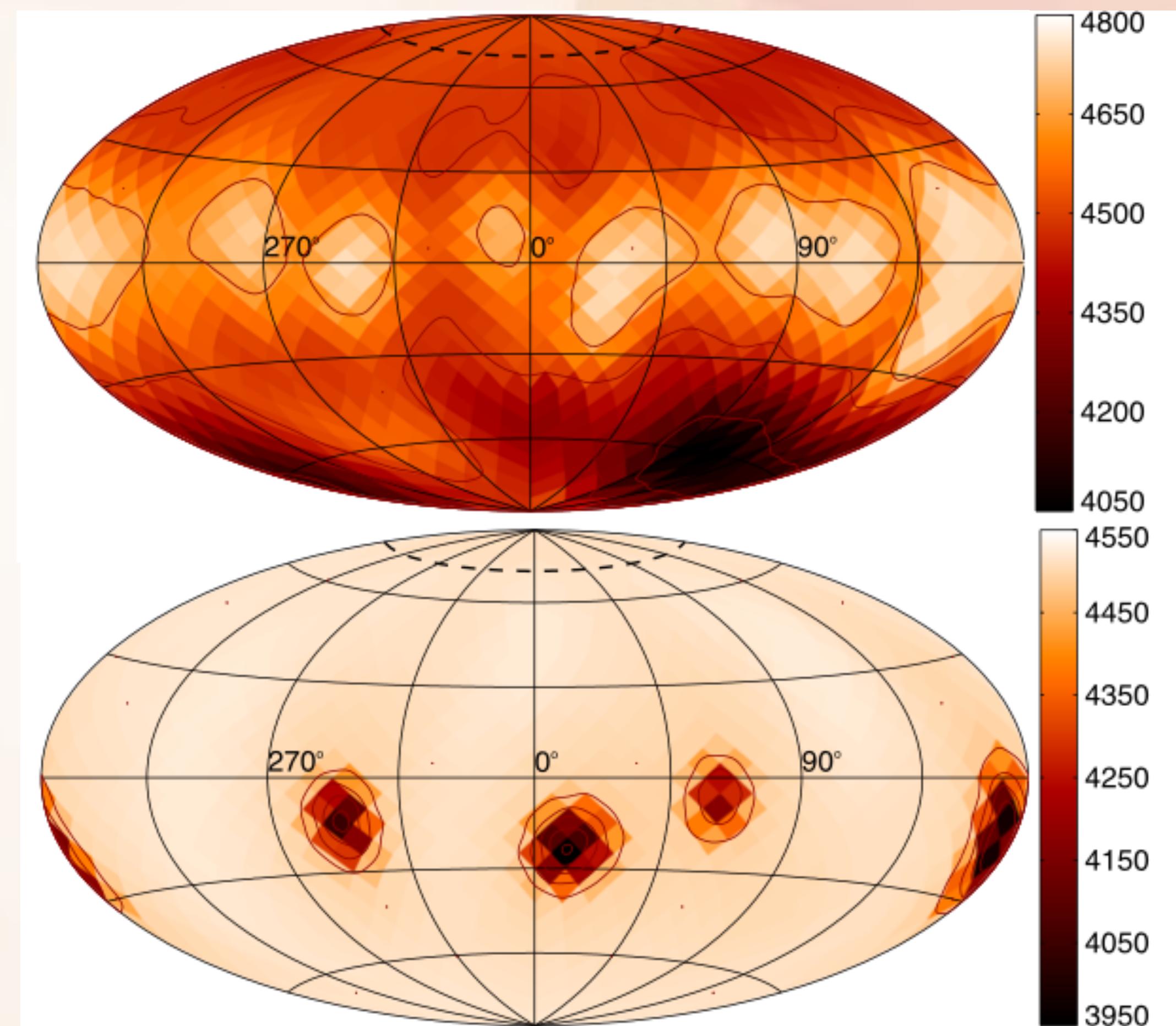
Starspots of σ Gem

2012 Imaging



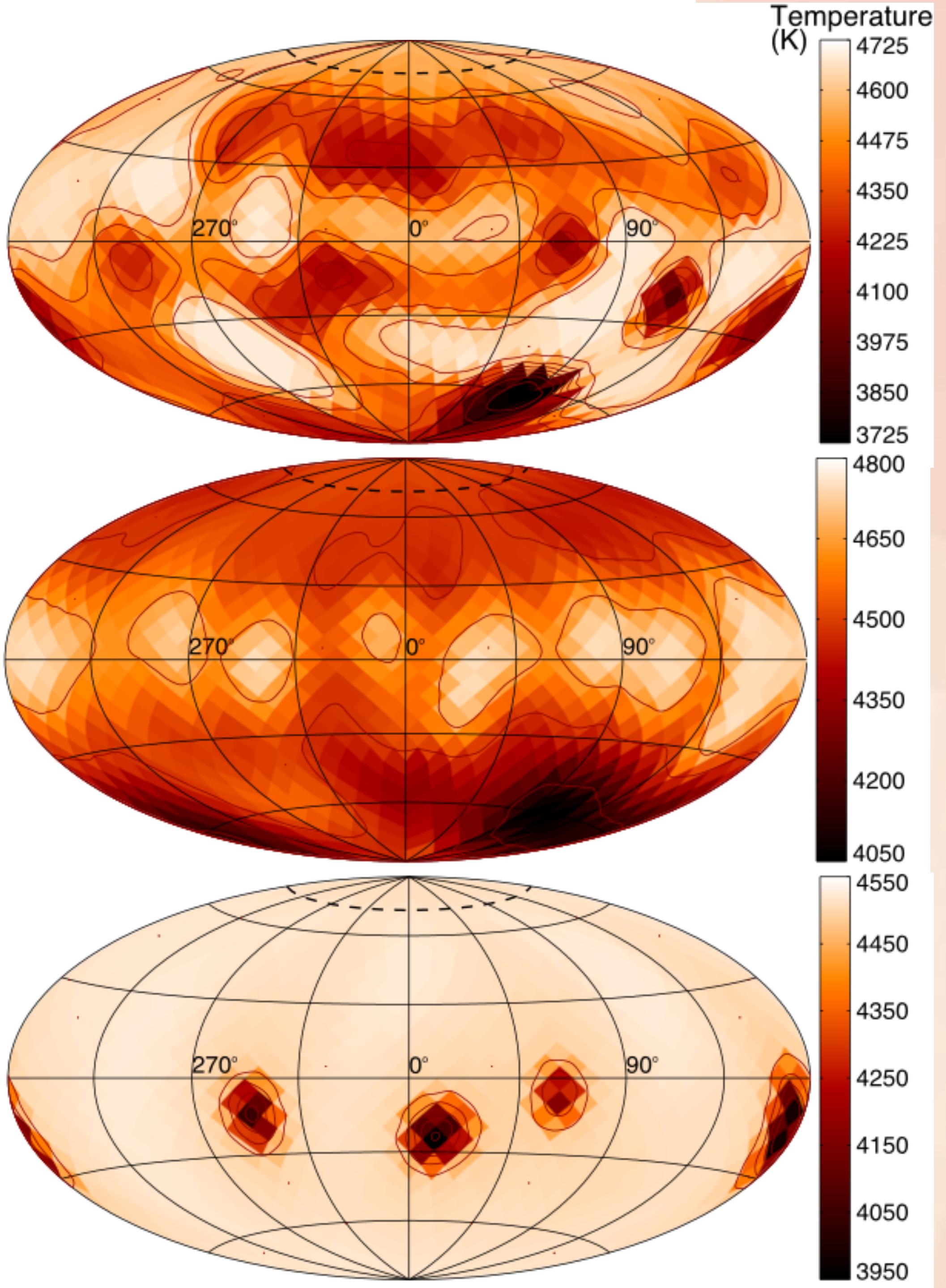
Starspots of σ Gem

2012 Imaging

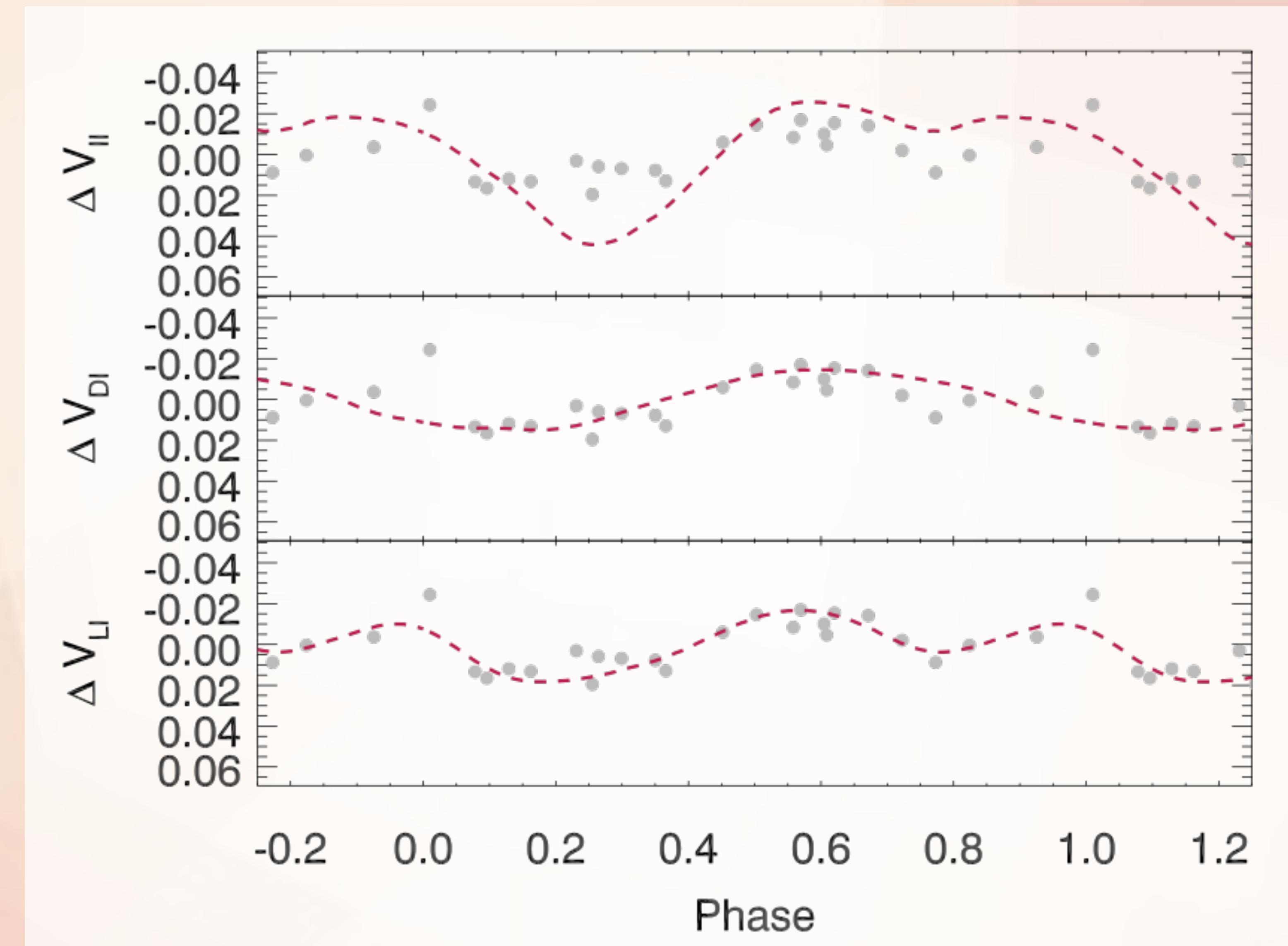


Starspots of σ Gem

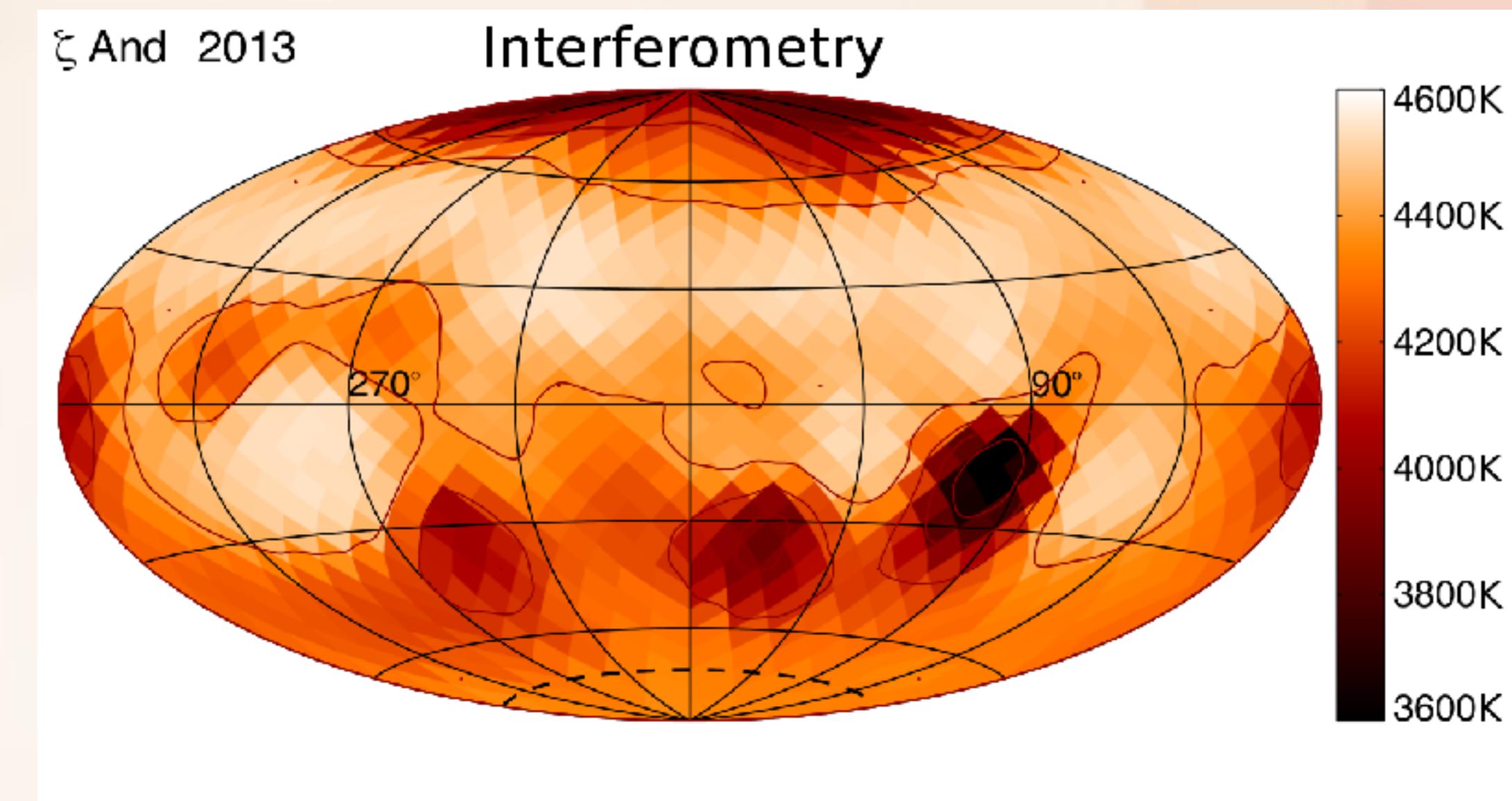
2012 Imaging



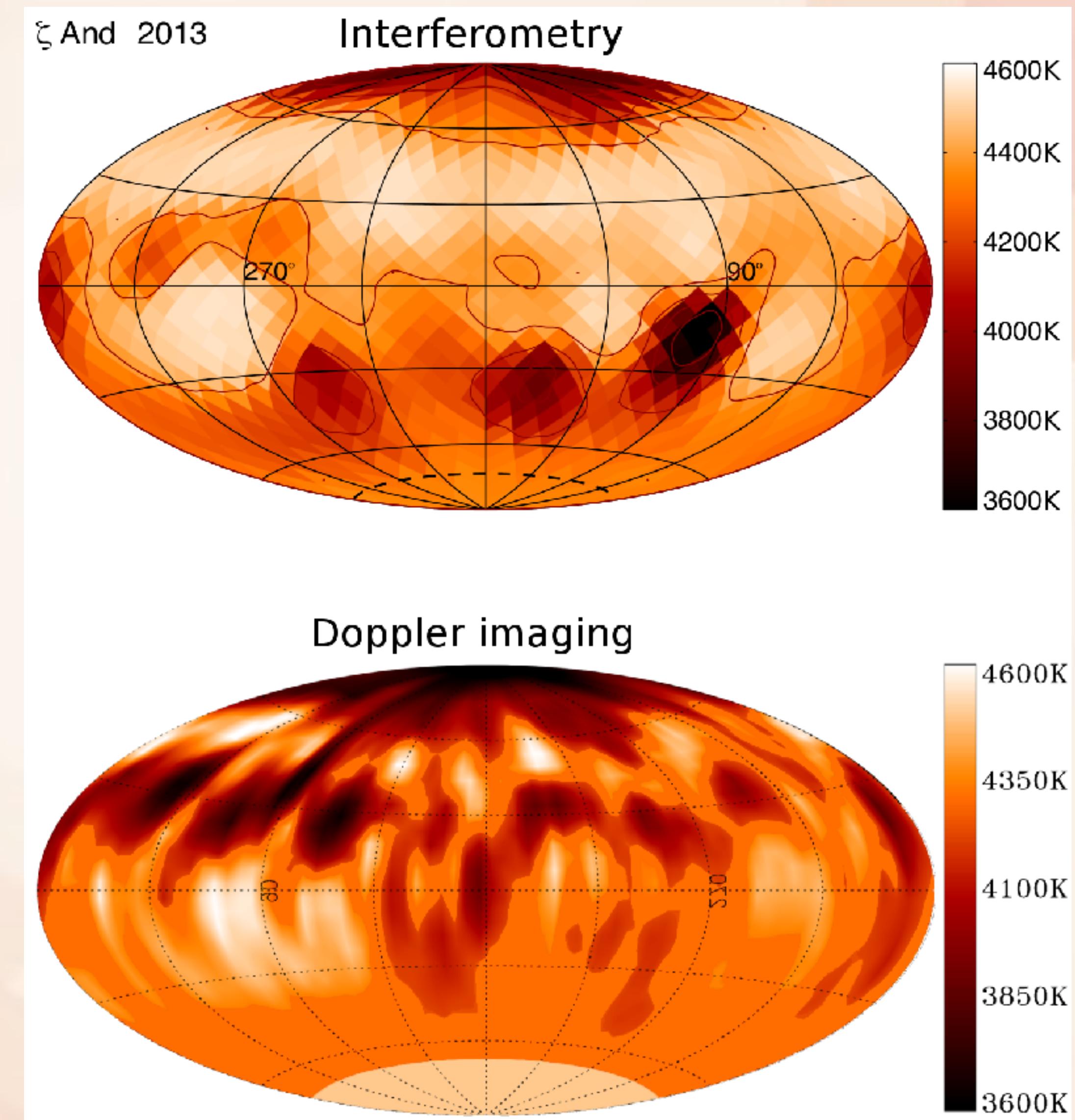
2012 Starspots of σ Gem



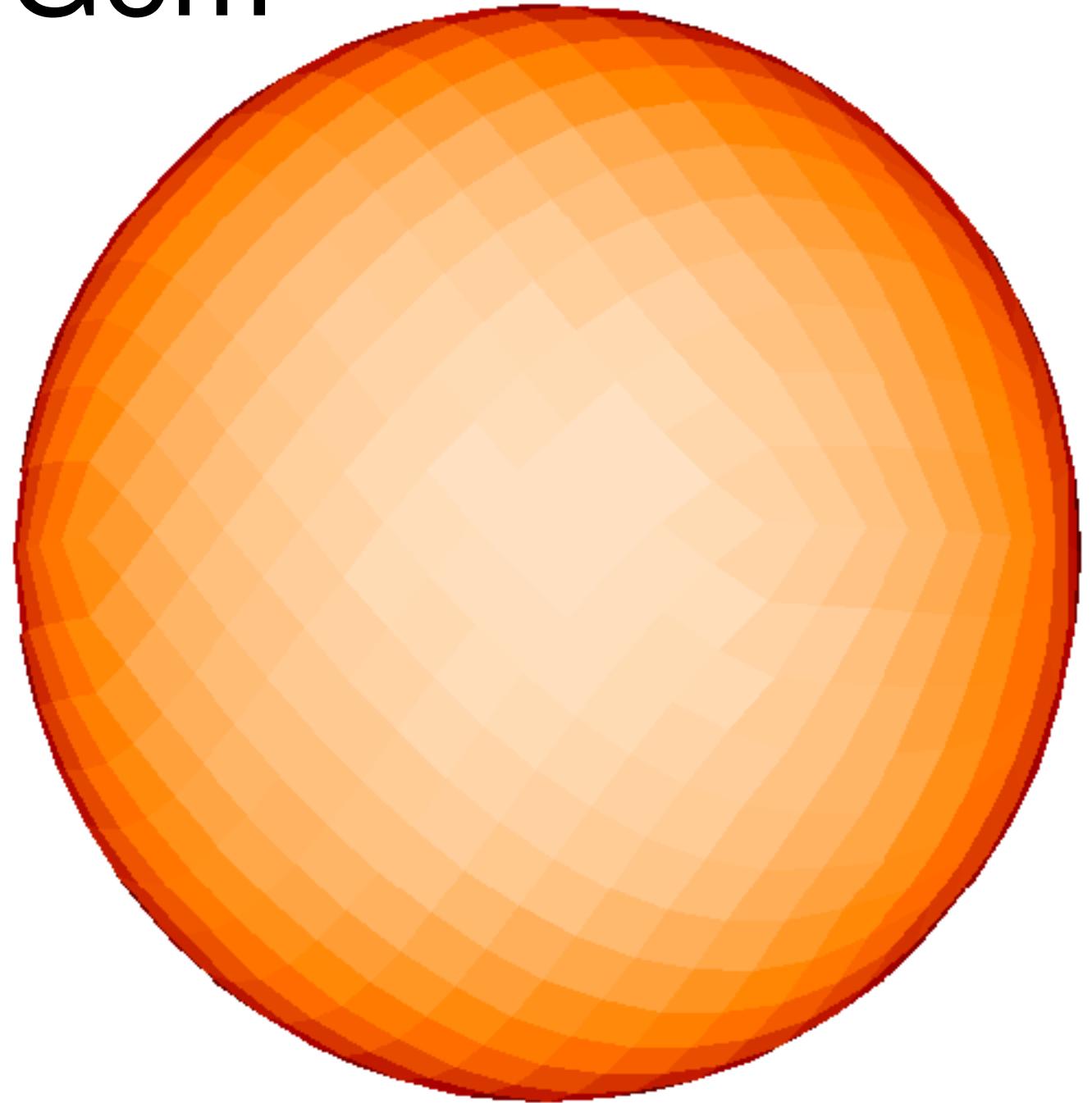
ζ And Imaging



ζ And Imaging

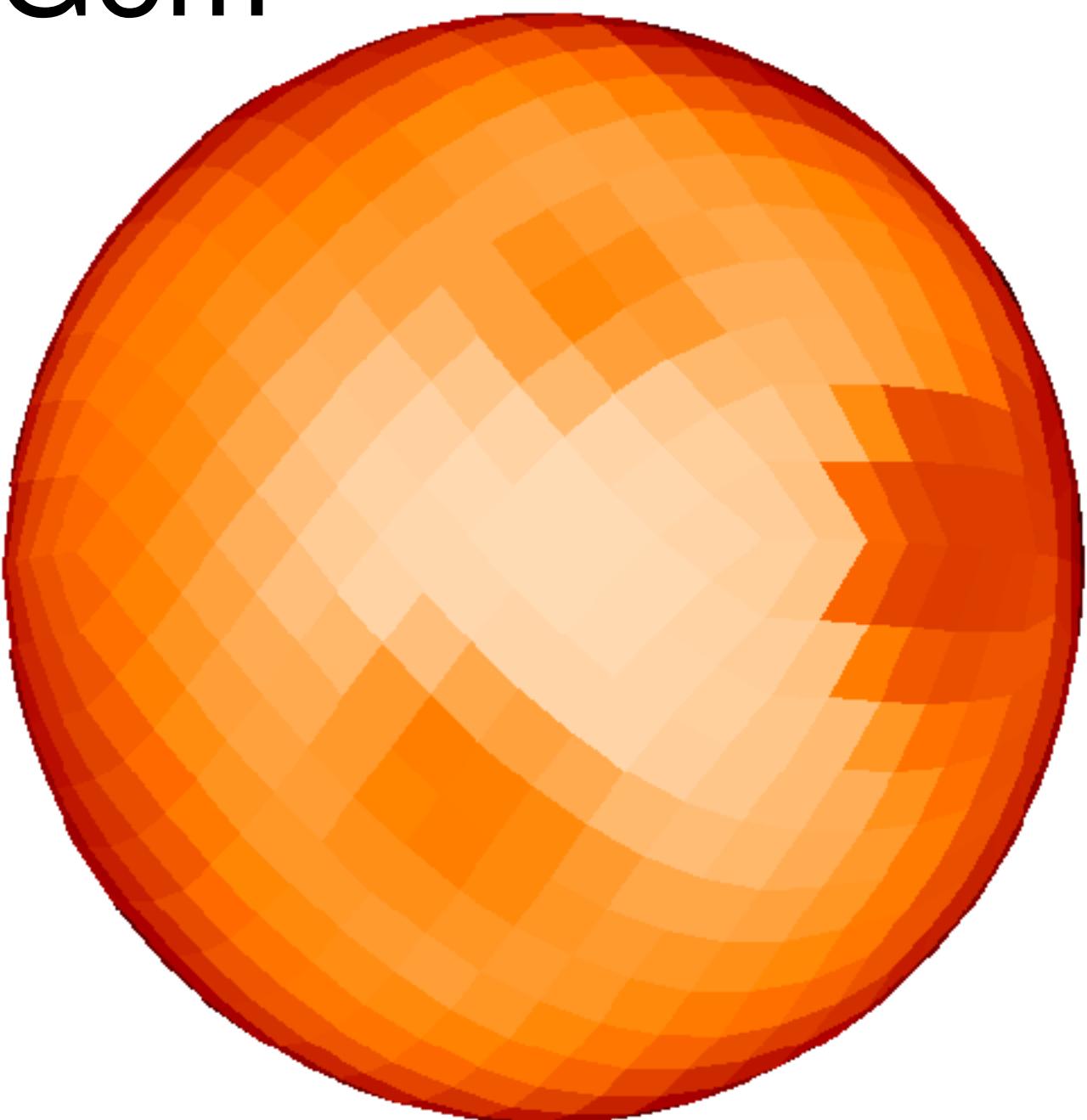


σ Gem



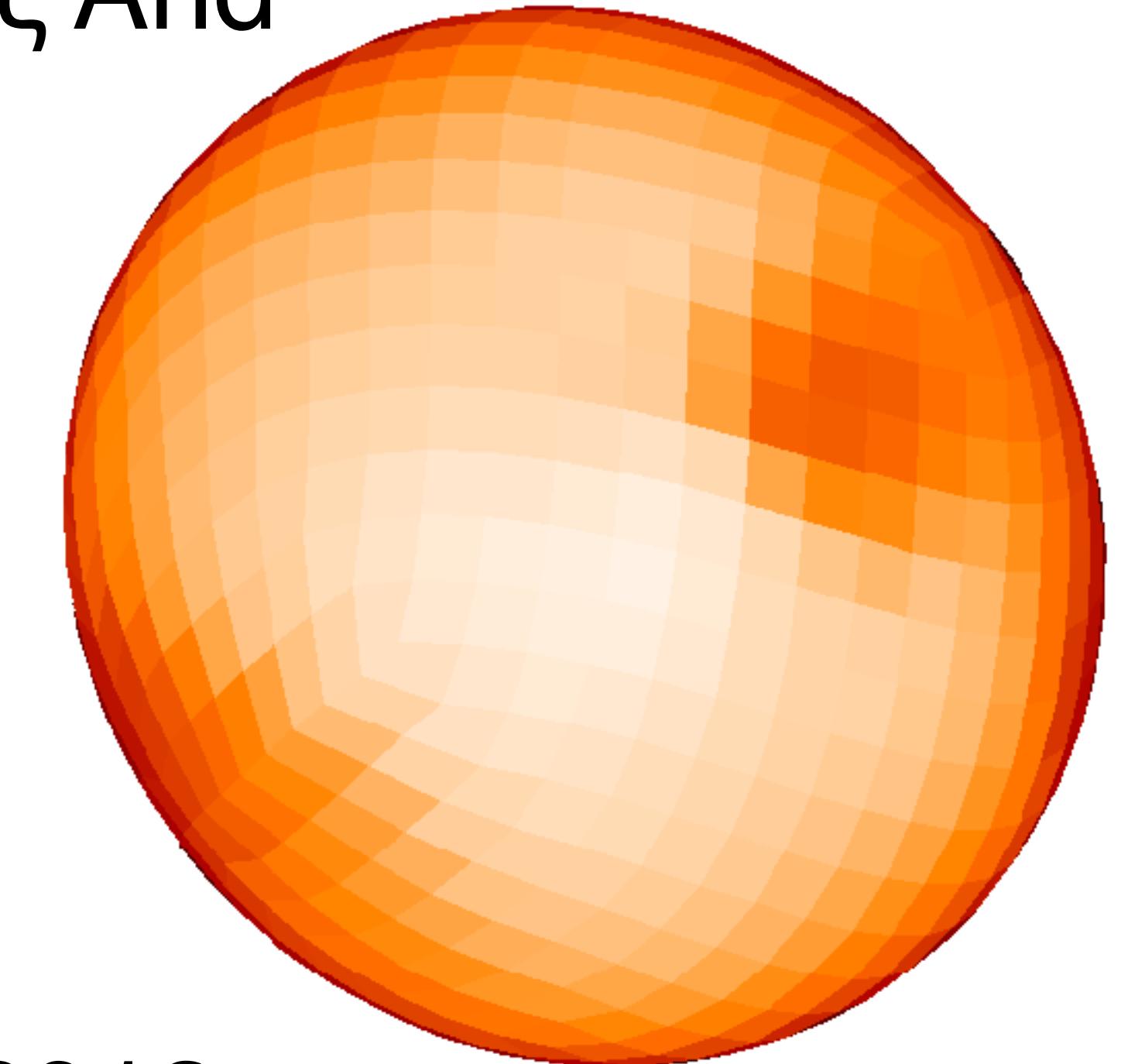
2011
 $\theta_{LD} = 2.4$ mas

σ Gem



2012

ζ And



2013
 $\theta_{LD, \text{pole}} = 2.5$ mas

Know thy Starspot, Know thy Star

2:00-5:30pm, Tuesday July 31, 2018

Speakers

Fabienne Bastien	Svetlana Berdyugina
Lauren Doyle	Helen Giles
Natalie Gosnell	Patrick Iwanek
Silva Järvinen	Aurora Kesseli
Lisa Lehmann	Jyri Lehtinen
Belinda Nicholson	Mayukh Panja
Ben Rackham	

Join us for talks and discussions on the latest observations, techniques, and theories of starspots!

SOC

Garrett Somers, *chair*
Rachael Roettenbacher
Michael Gully-Santiago
James Davenport