

# Extreme Adaptive Optics

QuickTime™ and a  
Microsoft Video 1 decompressor  
are needed to see this picture.

Marshall Perrin  
for the CfAO ExAOC Team:  
J. Graham, B. Macintosh, B. Oppenheimer, & *many*  
others!

# Extrasolar Planets

Over 110 exoplanets known from indirect searches

5% of targeted stars possess massive planets!

Doppler & Transit surveys raise new questions:

How do planets form?

Is the solar system typical?

What is the abundance of solar systems?

What produces the dynamical diversity in exoplanet systems?

Direct imaging can answer these questions!

It is a fast alternative to Doppler surveys

It searches greater stellocentric distances for planets

Characterizing the frequency and orbital geometries of planets  $> 3$  AU  
will show if our solar system is unique

Measuring colors and spectra determines planetary composition & chemistry

Imaging circumstellar disks probes planetary formation & migration

# What's so Extreme, anyway?

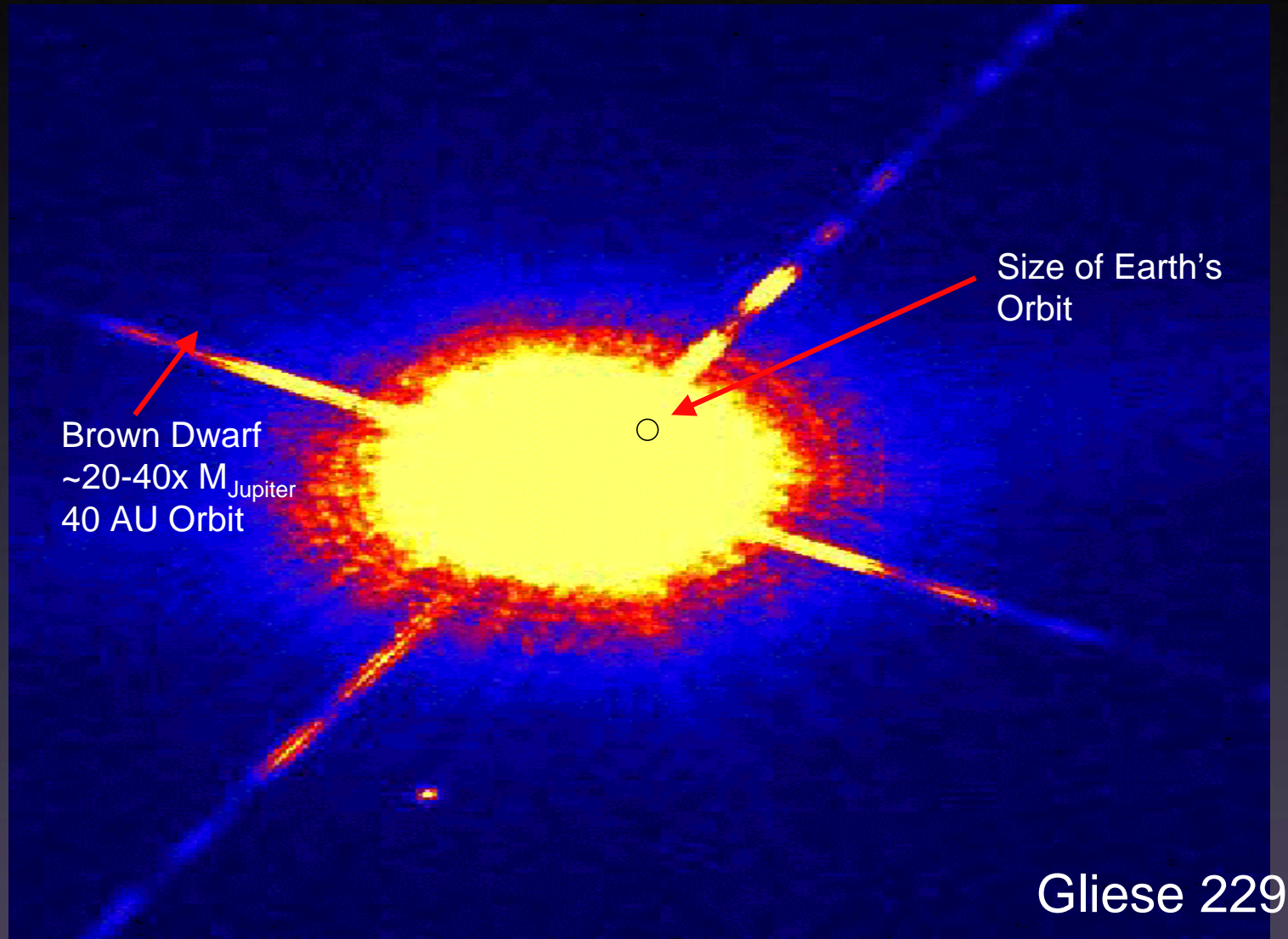
Deformable mirrors with  
4000-10000 actuators

Control systems running at  
2500 Hz

Total wavefront aberrations  
< 50 nm RMS

Strehl ratio > 0.95!

# Extrasolar Planet Imaging Requires High Angular Resolution & Ultra-High Contrast



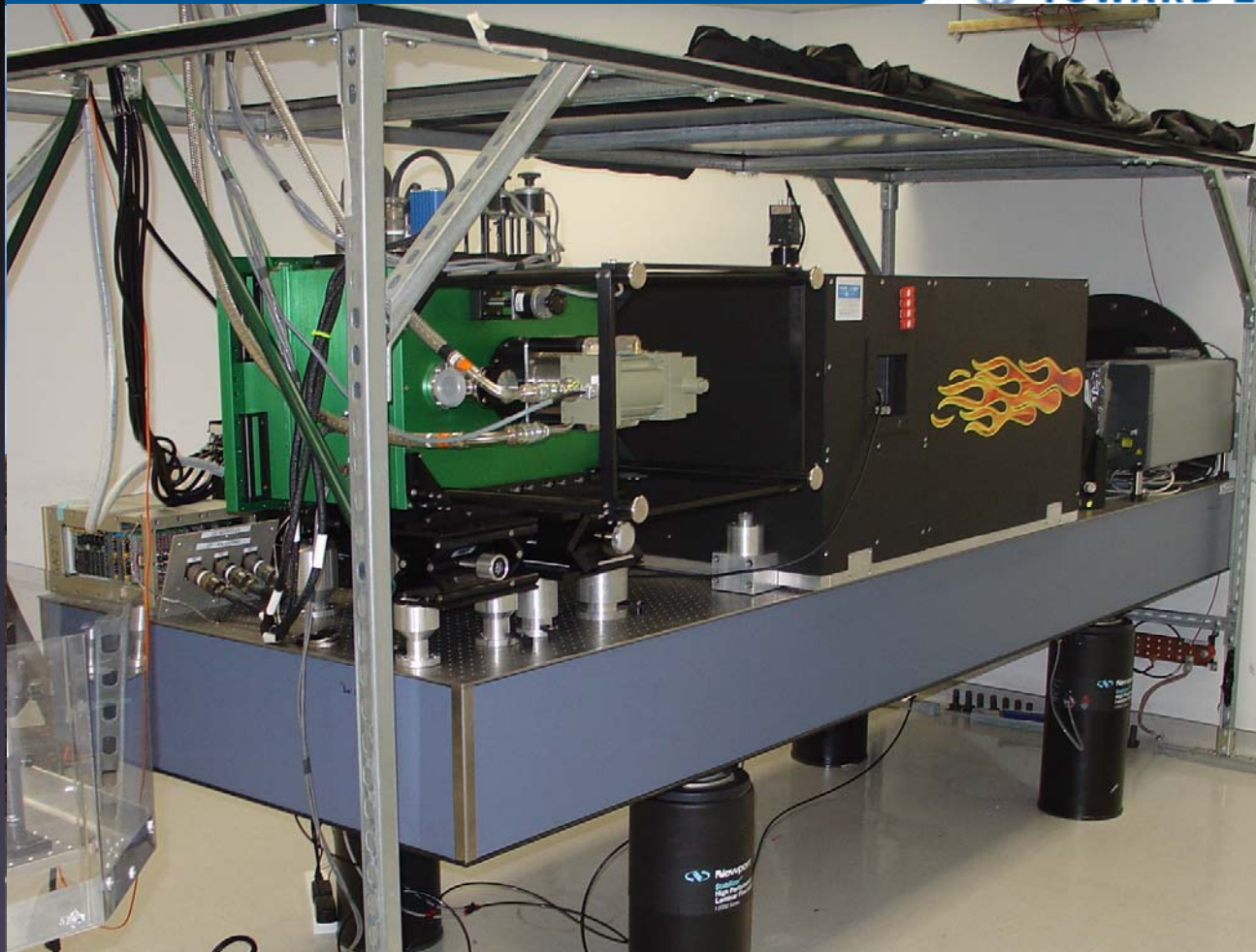
# Extreme AO on Maui

THE LYOT  
PROJECT

AMERICAN MUSEUM OF NATURAL HISTORY



TOWARD EXPLORATION OF OTHER WORLDS



High Contrast Coronagraphy  
with the AEOS 3.6m

CFAO, AMNH,  
UC Berkeley, U. Hawaii IfA,  
STScI, Cornell

Supported by NSF &  
AFOSR

First light 1 year ago this  
week!

# Extreme AO, Present and Future

- Lyot Project
- VLT NACO-SDI
- CfAO/LAO Testbed



- Gemini Planet Imager (2009?)
- VLT Planet Finder (2009?)
- NASA Terrestrial Planet Finder (2014?)
- TMT Terrestrial Planet Imager (2018?)