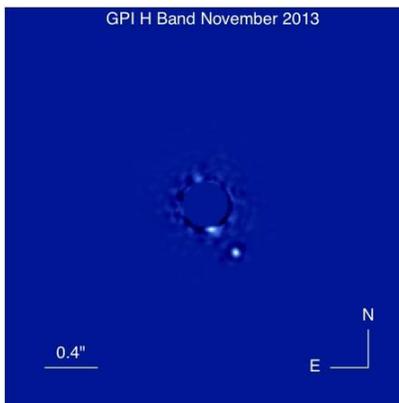


## High spatial-resolution wavefront corrector for next generation astronomy now a reality.

The 4K-DM is the enabling component for precise, high-speed, wavefront control on the Gemini Planet Imager, the most powerful exoplanet camera utilizing adaptive optics. With 4092 actuators controlled to under 1nm of precision and no hysteresis, the 4K-DM is ideal for demanding applications in astronomy. The high-speed drive electronics are capable of 20kHz frame rate and 14-bit step resolution. This combination takes high-precision atmospheric wavefront correction to a new level.

## New Images Enabled by the 4K-DM

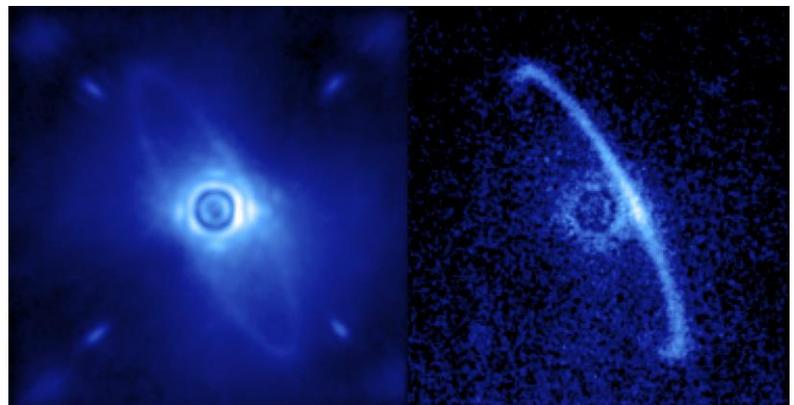


Beta Pictoris b is a giant planet – several times larger than Jupiter – and is approximately ten million years old. These near-infrared images (1.5-1.8  $\mu\text{m}$ ) show the planet glowing in infrared light from the heat released in its formation. The bright star Beta Pictoris is hidden behind a mask in the center of the images; a few scattered starlight artifacts, called ‘speckles,’ are also visible, but vastly fewer than in previous images

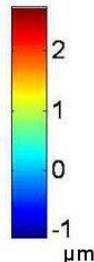
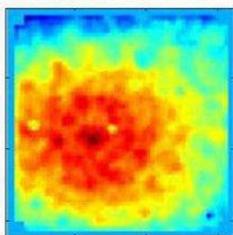
*GPI image credit: Image processing by Christian Marois, NRC Canada.*

Gemini Planet Imager’s first light image of the light scattered by a disk of dust orbiting the young star HR4796A. The left image (1.9-2.1  $\mu\text{m}$ ) shows normal light, including both the dust ring and the residual light from the central star scattered by turbulence in the Earth’s atmosphere. The right image shows only polarized light. Leftover starlight is unpolarized and hence removed from this image. The light from the front edge of the disk is strongly polarized as it scatters towards us.

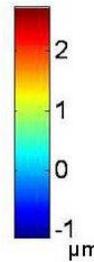
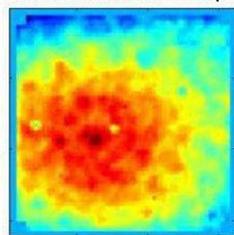
*Image credit: Processing by Marshall Perrin, Space Telescope Science Institute*



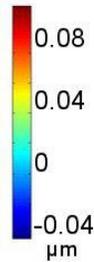
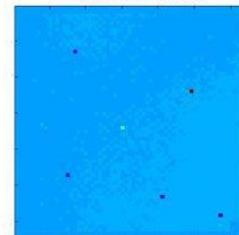
Desired DM Shape



Measured DM Shape



Shape Error  
22.6 nm RMS



### Gemini Planet Imager testing results.

Left: Example of wavefront error (WFE) that the 4K-DM is expected to see due to atmospheric turbulence when the instrument is installed on the Gemini telescope.

Center: The controlled DM shape to correct for the WFE.

Right: The residual error after correction ( $<\lambda/20$ ).