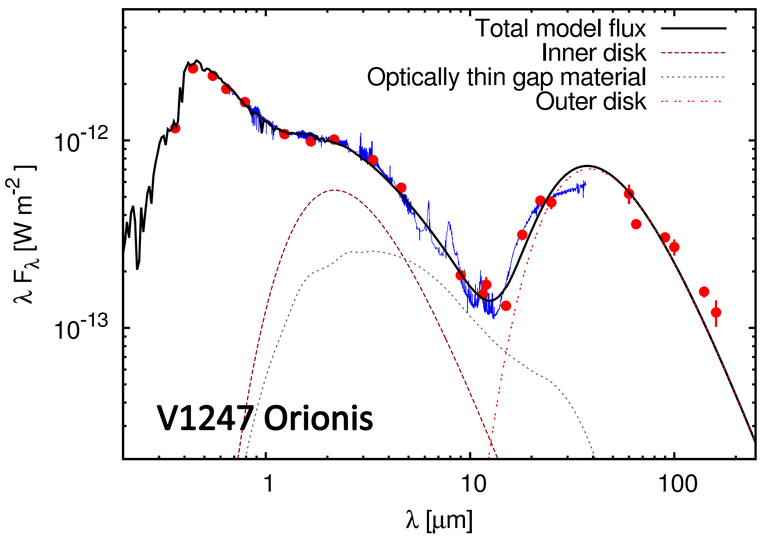
Resolving the gap and AU-scale asymmetries in pre-transitional disks with multi-wavelength interferometry

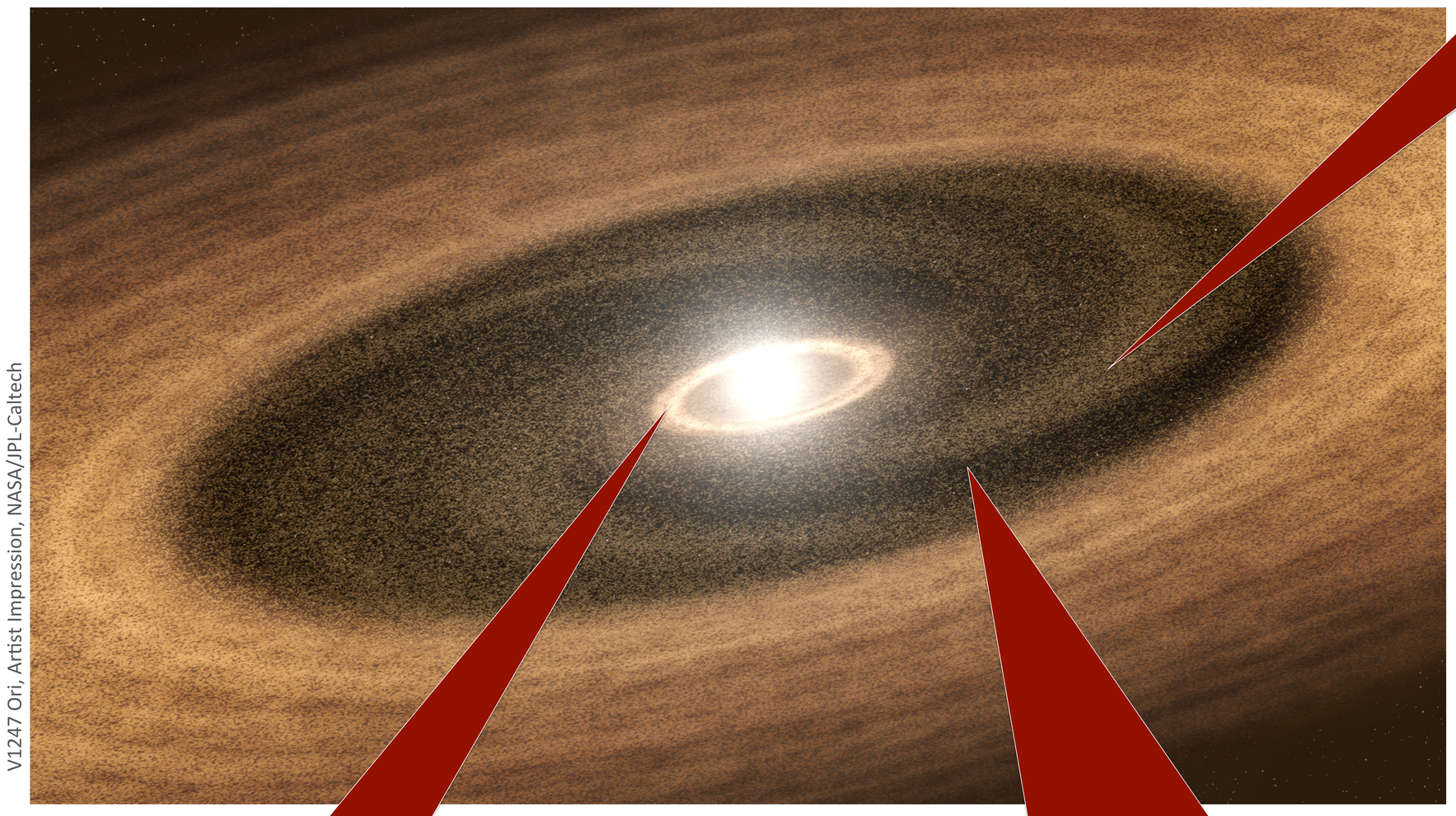
Stefan Kraus[1,2,3], Michael Ireland[4], Michael Sitko[5,6,10], John Monnier[3], Nuria Calvet[3], Catherine Espaillat[2], Carol Grady[7], Tim Harries[1], Sebastian Hönig[8], Ray Russell[9,10], Daryl Kim[9,10], Jeremy Swearingen[5], Chelsea Werren[5], David Wilner[2]

(1) University of Exeter, (2) Harvard-Smithsonian Center for Astrophysics, (3) University of Michigan, (4) Macquarie University, (5) University of Cincinnati, (6) Space Science Institute, (7) Eureka Scientific Inc. and Goddard Space Flight Center, (8) University of California Santa Barbara, (9) The Aerospace Corporation, (10) Visiting Scientist NASA IRTF



Pre-transitional disks exhibit a significantly reduced mid-infrared excess compared to classical (T Tauri-type) protoplanetary disks, possibly indicating a gapped disk structure.

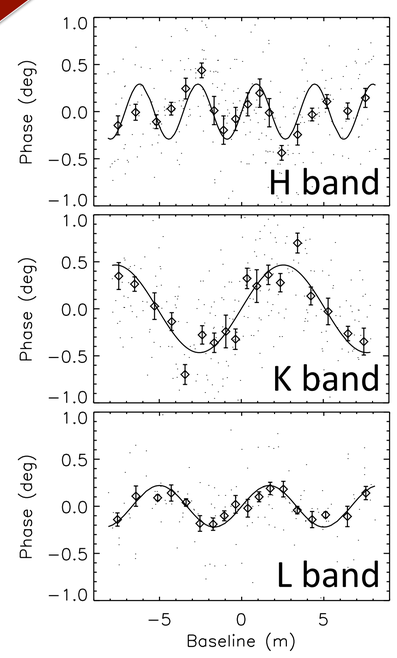
We employ near- and mid-infrared interferometry in order to study the structure of these objects and to solve ambiguities that result from fitting the SED alone.



Optically thick inner disk (R=0.18-0.27 AU), resolved by VLTI/AMBER + KI/ASTRA near-infrared interferometry

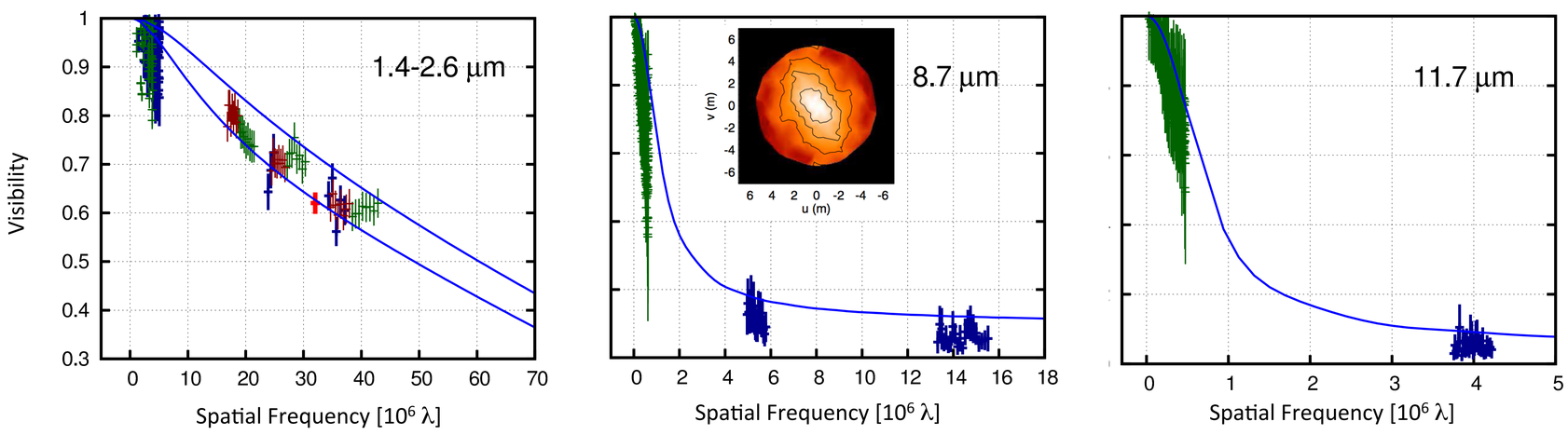
Optically thin material located in the gap (R=0.27-46 AU), resolved by VLTI/MIDI + Gemini/TReCS mid-infrared speckle interferometry

Density inhomogeneities in the gap region, detected with Keck/NIRC2 aperture masking interferometry



➔ The detected asymmetries trace complex density structures on AU-scales.

➔ We caution that these signatures can be easily misinterpreted as companion signatures.



➔ We detect a narrow ring of optically thick hot dust at the dust sublimation radius, followed by an extended disk gap.

➔ The gap in V1247 Ori is filled with substantial amounts of optically thin material ($\Sigma_{gap} \approx 9 \times 10^{-6}$ g/cm^2) with a carbon-dominated dust mineralogy. The presence of this optically thin material cannot be deduced from the SED alone.

➔ Our IRTF/SpeX+BASS spectra show strong hydrocarbon-related ("PAH") line-emission, whose spatial origin we constrain with MIDI interferometry to within the gap region.

RESULTS: V1247 Ori

- Spatially resolved observations provide unambiguous evidence for a gapped disk structure.
- The gap is filled with substantial amounts of optically thin carbonaceous dust, possibly indicating a particularly early stage of disk clearing.
- Complex density inhomogeneities might reflect the dynamical interaction of disk material with the gap-opening bodies.

Future directions of work:

- Observations on a larger sample of transitional & pre-transitional disks are needed to establish the evolutionary sequence of disk clearing.
- Multi-epoch interferometric imaging could unravel the origin, structure and time-evolution of the detected asymmetries.

Reference: Kraus et al. 2013, ApJ 768, 80; Contact: skraus@astro.ex.ac.uk

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