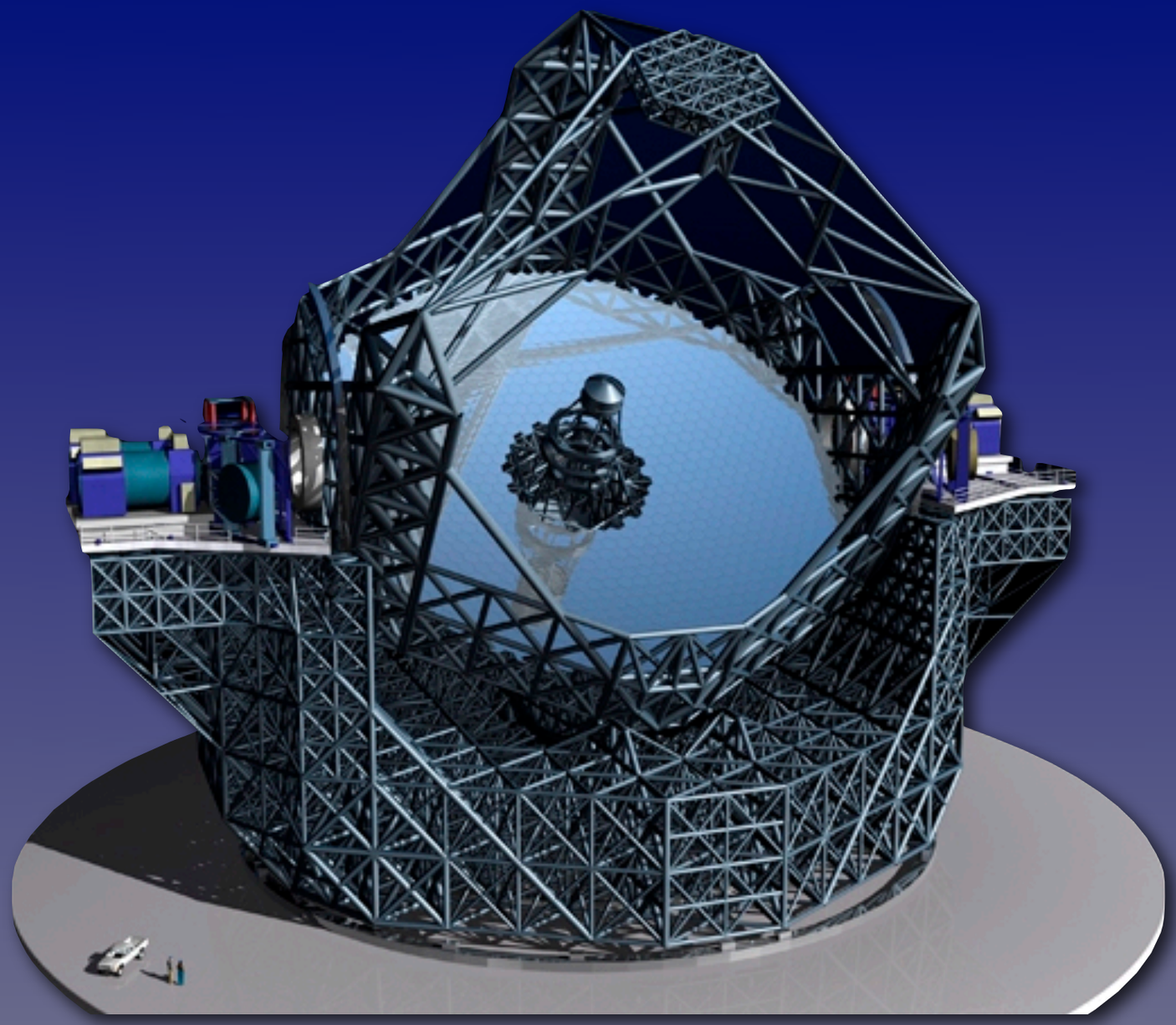

E-ELT circumstellar disk simulations status

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E-ELT SWG meeting, ESO Garching, October 9 2007

Two core science cases for the DRM

- **High spatial resolution imaging at 2-20μm**
  - Search for structures in disks indicative of ongoing or completed planet formation: gaps, rings, spiral density waves
  - Young, optically-thick disks in star forming regions
  - Older, optically-thin dust debris disks in solar neighbourhood
  - Diffraction-limited broad/medium/narrow-band imaging
  - Single object, small FOV
- **Spectroscopy of gas and dust at 2-20μm**
  - Tracing dynamics and physical/astrochemical evolution
  - Watching the transition to protoplanets at 1-100 Myr
  - R=300, 3000, 100 000 spectroscopy
  - High Strehl ratio useful to increase sensitivity
  - IFU spectroscopy useful to image differential structures in disk

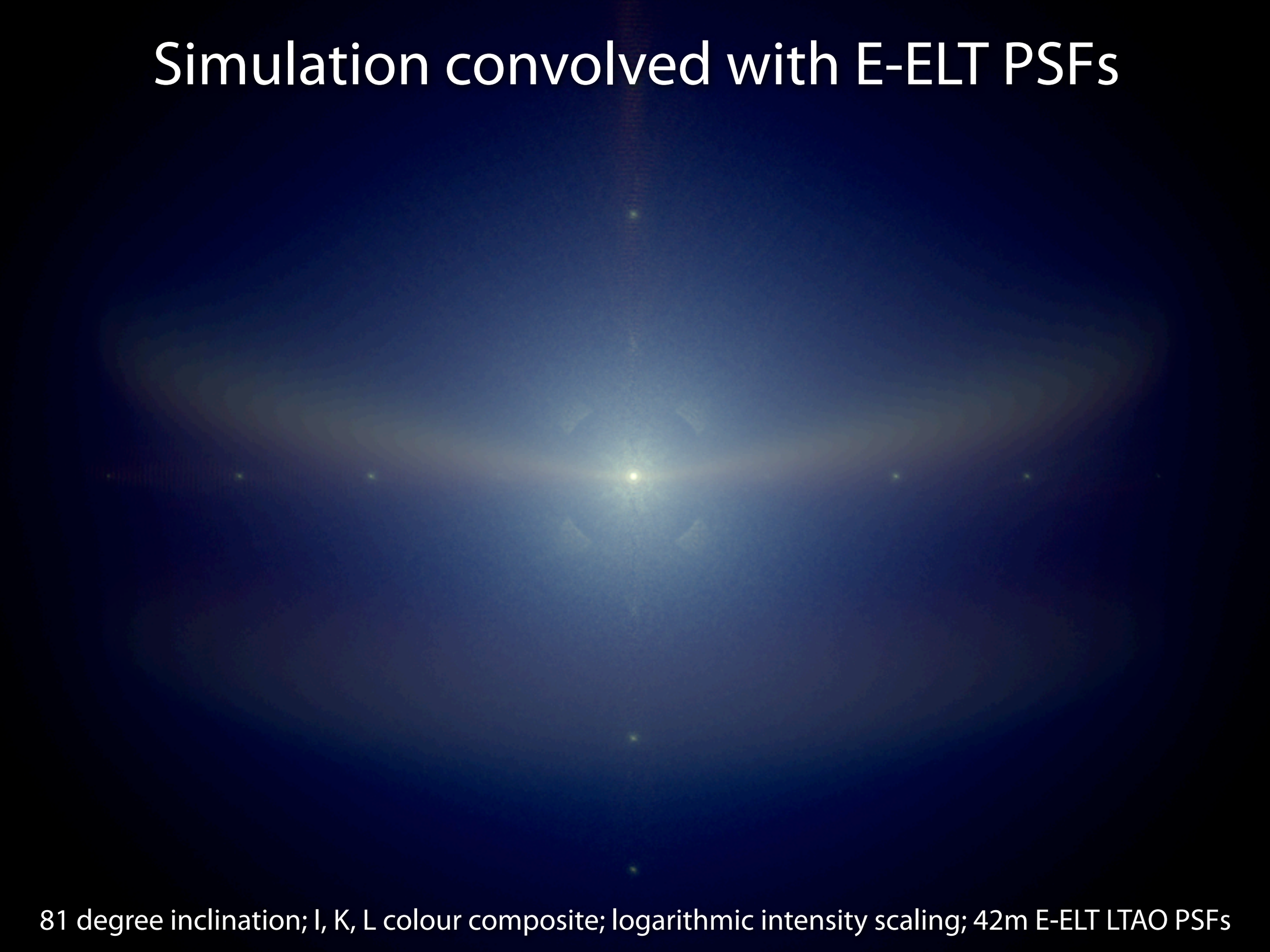
Start made on imaging simulations

- Monte-Carlo radiative transfer simulations for young, low-mass circumstellar disk
  - Done by Christophe Pinte (Exeter) using MC FOST code
    - Computationally intensive at small pixel scales: some imprinting of model grid still visible
  - Modelled on IM Lup system
    - Young system with optically-thin disk seen in scattered light at optical/near-IR wavelengths
    - Star: T_{eff} 3900K, 3 solar radii, at distance of 140 pc
    - Disk: dust mass 10^{-3} $M_{\odot}$ (total mass 0.1$M_{\odot}$), inner radius 0.775AU, outer radius 400AU; no gaps
  - Simulations set spans range of parameters
    - I, J, K, L-band images at 10 inclinations (18, 31, 42, 49, 57, 63, 70, 76, 81, 87 degrees)
    - All Stokes polarisation states available too
  - Pixel scale set at 5 mas
    - 1 AU at 140 pc = 7 mas; diffraction limit of 42 m E-ELT at 2 μm = 12 mas
  - Convolved with E-ELT LTAO PSFs at I, J, K, L
    - Provided by Joe Liske
  - Model fluxes are calibrated so full S/N calculations possible

Pure model simulation

81 degree inclination; I, K, L colour composite; logarithmic intensity scaling

Simulation convolved with E-ELT PSFs



81 degree inclination; I, K, L colour composite; logarithmic intensity scaling; 42m E-ELT LTAO PSFs

Initial thoughts

- Poor short-λ AO performance washes out detail
  - Better to concentrate on longer-λ's?
  - But smaller span in λ is less diagnostic of disk/dust properties
  - Also shorter λ's still have nominally higher spatial resolution
  - Can deconvolution be applied?
- Need to add structures (gaps, rings)
  - See how good feature contrast is after PSF convolution
- Need to run proper S/N calculations to add noise
  - Images are flux calibrated so relatively trivial
- Need PSFs for longer λ's out to 20μm
- Need also to look at optically-thin debris disks