Review of Day 3

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Evolved Stars (B. Mennesson).

- Giants, Supergiants (esp. Miras & semi-regular variables).
- Rich spectra, but need spatial resolution to determine the spatial scales involved.
- As in other domains, spectroscopy and interferometry are highly complementary and both needed to constrain models.
- Miras & SR variables: bright and big, ideal for OI! (many 100s of targets).
- Spectacular physics: high mass loss (10^{-5} Msun/yr), x10-1000 brightness changes over 80-1000 day periods.
- Complicated systems: extended atmosphere with molecular and dust layers. Would like to understand the size of the “photosphere”, chemistry and location of the layers, and the pulsation & mass loss mechanism.
- UD sizes change drastically with λ, clearly an opacity effect (molecules or dust). Visible λs: strong “contamination” by molecular bands. Thermal-IR: see mostly the large dust shell. Near-IR: possibly best probe of photosphere. On top of that, stars could be asymmetric (independent reason for visibility variations).
- Good progress made using: star + one nearby warm molecular layer (CO, $H_2 0$) + cold dust models, good observing strategy, multiple spectral broad bands and narrow bands (in & out continuum). “Molsphere” also consistent with Maser locations. Inferred photospheric radii are smaller, favoring fundamental mode pulsation.
- To reconcile with detailed spectra, more refined models, including dust formation, are needed. Also, need to understand the nature and formation of the close, warm, molecular layer.

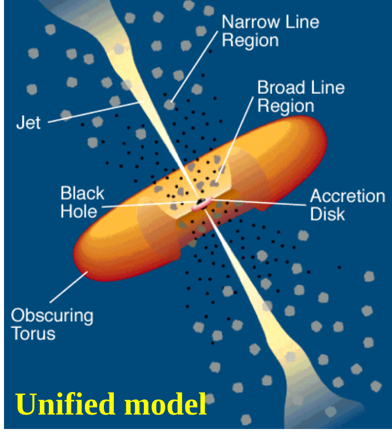
- Also probing dust chemistry via spectrally & spatially resolved Mid-IT observations (KI, VLTI/MIDI).
- Asymmetry detections using closure phases (indicates that most Miras appear asymmetric). Now needs targeted observations of individual stars.
- A bright future:
  - Many powerful instruments with spectral resolution in various λ regimes (KI, MIDI, AMBER, CHARA ...).
  - Need serious physical modelling.
  - Important to coordinate among facilities to optimally observe individual targets.

Young Stellar Objects (J. Eisner)

- Interferometers resolve disks (& winds & envelopes) surrounding young stars; providing insight into:
  - Disk physical structure (size, T-distribution ...) and dust properties.
  - Accretion process.
  - Initial conditions for planet formation.
  - Migration.
- A very recent, but fruitfull field.
- Again, SEDs alone cannot distinguish competing disk models with different geometries, Ts, dust properties, etc.
- Important contributions for many objects of all types:
  - Old, optically thin disks (TW Hya).
  - Younger, optically thick disks (HAe/Be, T Tauris).
  - Outburst (youngest?) objects (FU Oris).

- Some findings:
  - Early NIR (IOTA, PTI) measurements motivated in part of revision of models of inner disk structure (the “puffed-up” inner rim).
  - New constraints of the detailed profile of this inner rim (cannot be very sharp) from PTI spectrally dispersed data (also IOTA closure phases).
  - Inner dust disk radii can be compared to gas disk radii (from IR spectroscopy, and location of terrestrial planets and hot jupiters: implications for accretion theories, planet formation, migration mechanisms.
  - VLTI/MIDI detects mineralogy gradients in the outer disk (1-10 AU).
  - FU Ori objects are complicated ... and maybe not an homogeneous class from the point of view of disk/envelope properties. Progress needed here.
- Next:
  - Exploit spectral resolution and probe disk gas (and winds) directly.
  - Polarimetry (disk scattered light), probes τ vs. R.
  - Imaging.
  - Connect inner & outer (mm) disk morphologies.

Active Galactic Nuclei (M. Swain)



- The first extra-galactic observations using optical interferometry are here!
- AGNs are nuclei of galaxies, exhibiting fascinating highly energetic phenomena, thought to be related to central black holes.
- Only optical interferometers can spatially resolve the central engines in these systems (central accretion disk, putative dust torus).
- Other observations suggest a unified model for the variety of AGN types and phenomena (same physical system, viewed from different lines of sight).
- 2 objects published so far (NGC 4151, NGC 1068; types 1 and 2 respectively) by KI and VLTI, observations both NIR and Mid-IR.
- Results are generally consistent with the unified model (more fractional flux coming from surrounding material at larger spatial scales when central engine is partially obscured -- S2 types). Spectro/interferometric observations (MIDI) also detect Si feature.
- Issues: thermal dust (torus) or thermal gas (accretion disk) emission? (can be tested with size vs. λ observations); detect time-variability (orbital motion); probe the BLR directly.
- More objects in the VLTI/MIDI pipeline, a total of 6 now.
- Spectacular progress is to be expected from existing (VLTI/MIDI-AMBER) and planned instruments (KI @ 3 um).