# Constraining the Mass of the Putative IMBH in the Core of GCIRS13E

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# Motivation

In the very close vicinity of our galactic supermassive black hole are a few dozen young stars. → Paradox of youth

These stars might have migrated from further out (Gerhard '01)

In order for the migration scenario to work, the cluster stars have to be bound by an IMBH of mass $\sim 10^3 M_0$ (Milosavljevic '03).

SHARP survey (Ott et al. '99) indicates bulk motion of stars in GCIRS13E.

→ candidate for a star cluster harbouring an IMBH, with a distance of 2as from the central hole.

Challenge: No IMBH has been confirmed robustly to exist yet !!!

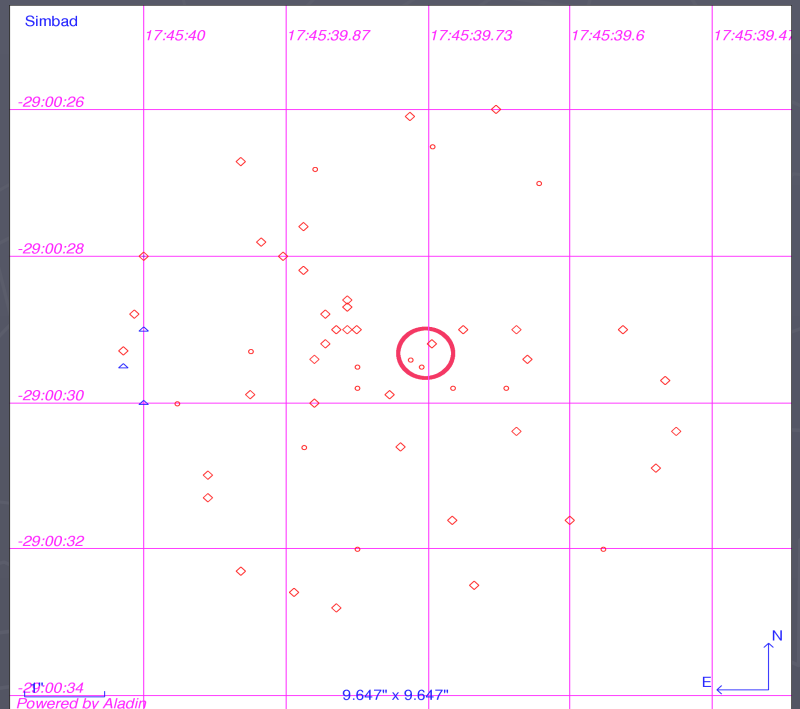
# Proposal

Successive imaging of 3 brightest stars in GCIRS13E with VLTI using

AMBER + PRIMA to determine the proper motions of the target stars.

- Radial velocities ~ 30 km/s (Maillard et al. ’04)
- This is equal to the orbital velocity to zeroth order.
  → translates into ~ 0.7 mas/yr for our target stars (at D = 8 kpc)
- With AO/single dish, only proper motions of order a few mas/yr

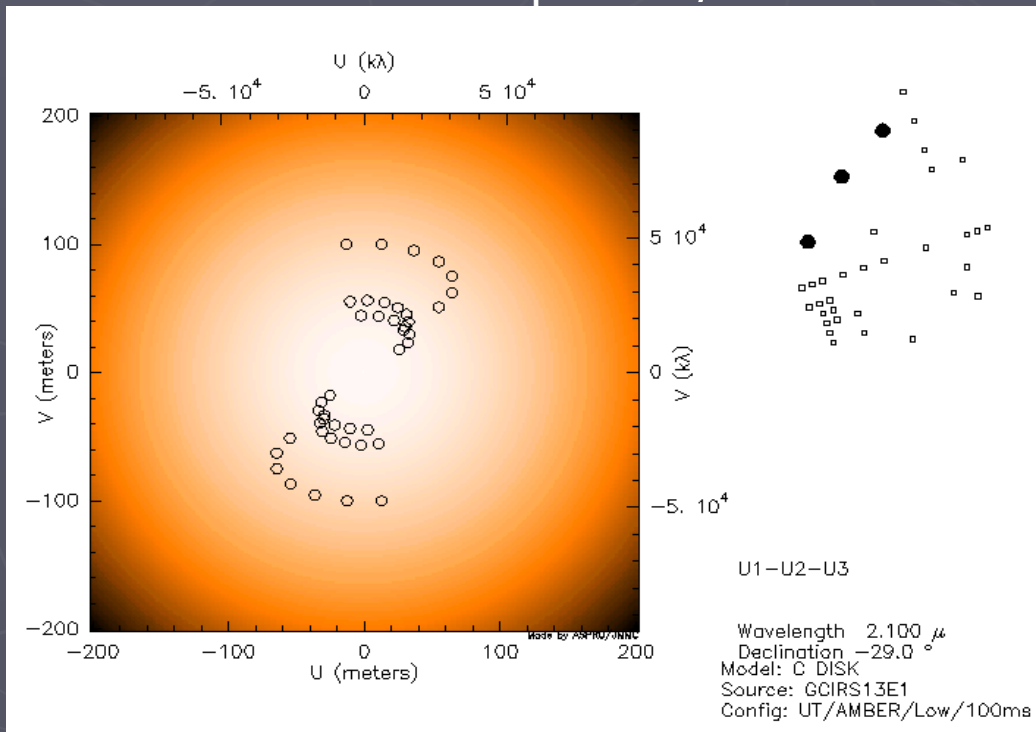
  detectable.
- USE VLTI !!!



# How-When-Where to Observe?

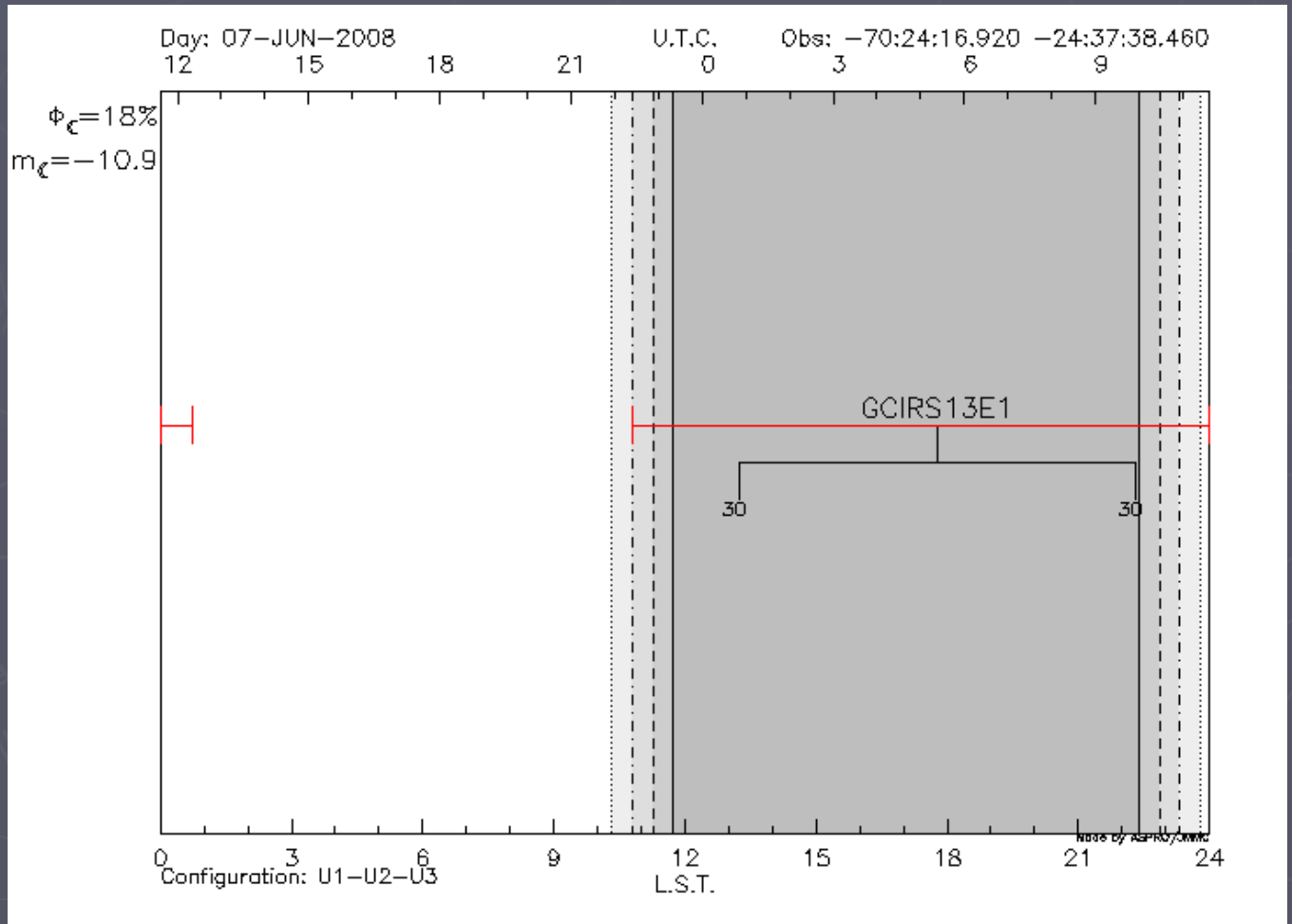
- AMBER: K-band allows 5 times higher spatial resolution than N-band
- PRIMA: limiting Kmag ~ 12, proposed stars ~ 11 (AMBER alone ~ 7)
- stars will remain unresolved!

  (typical O star at 8 kpc ~ 0.1 mas angular diameter; but res ~ 2 mas)
- Science still ok, want to follow center of brightness
- maximize number of uv points for image reconstruction (CLEAN, iterative modeling, maximum entropy)
  --> we request 1 full night/yr with AMBER = ~ 6 uv points / star
- For calibration use HD170499 (CalVin): ang. dist. 10deg., diameter 1.2mas, Kmag 3



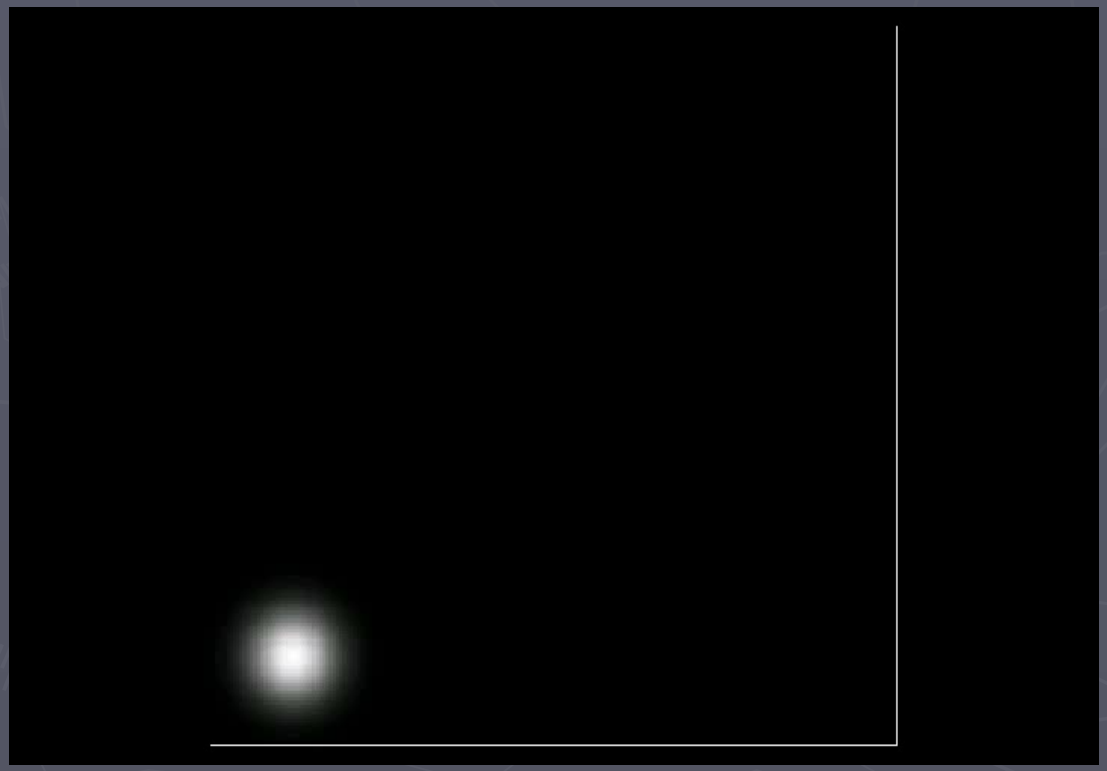
# How-When-Where to Observe?

- Use U1 U2 U3 (the only UT baseline combination with delay lines available over full night for our targets)
  → many uv points, better image reconstruction
- Observing time: ~ early June
- (targets visible all night long, moon not a problem)



# Why is PRIMA crucial?

- Only dual feed phase-referenced fringe tracking allows Kmag ~ 12
- Only PRIMA metrology allows absolute astrometry
  (crucial for proper motions)



- expected displacement: ~ 0.7 mas/yr
- acceleration: ~ 0.2 mas/yr^2

→ constrain mass of the IMBH

# Concluding Remarks

- use low spectral resolution mode
  → fainter limiting magnitude

- we observe 13E1 & 13E2 & 13E4 in IRS13E in the GC
  → faint (Kmag 10-11)

- requirements:
  - continuous follow-up observations ~ 1yr for some years
  - PRIMA metrology crucial for fainter Kmag and astrometry
  - very good seeing

- same science could be done with Matisse much faster

# Thank you...

(also thanks to Ric and Jörg-Uwe for valuable suggestions)