# Event-horizon scale observations of Sgr A* with GRAVITY

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on behalf of the LESIA GRAVITY team

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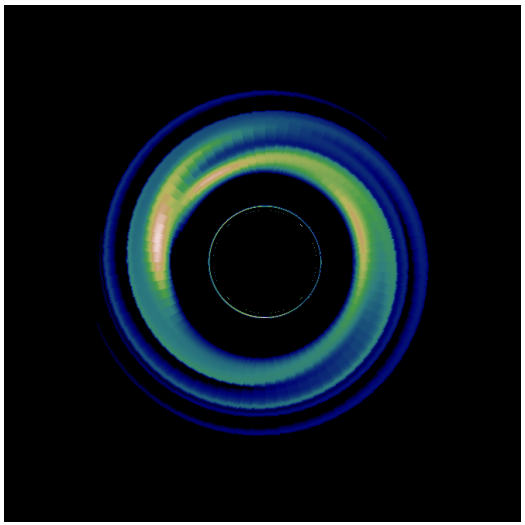
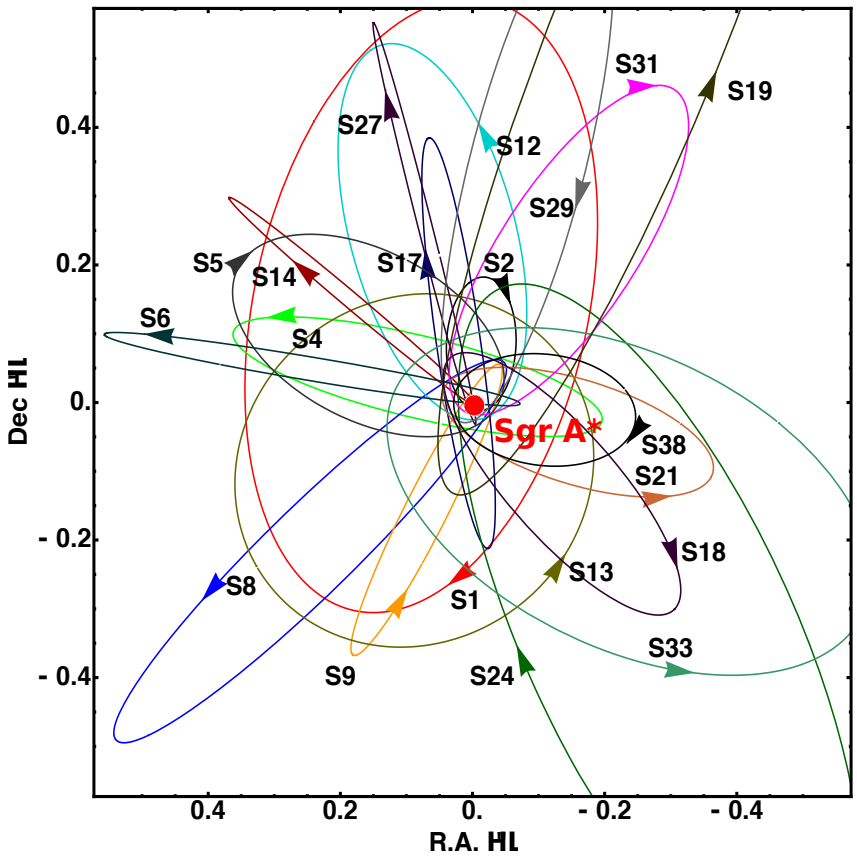
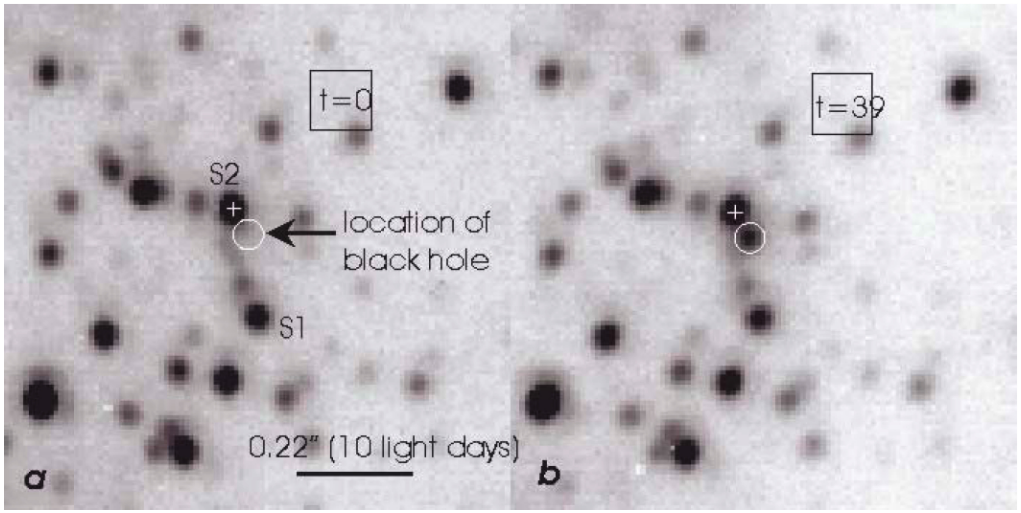




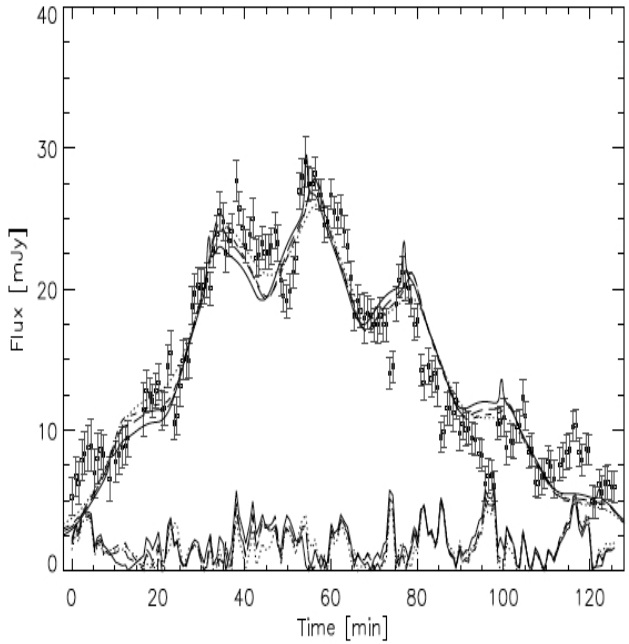

S-stars cluster (Gillessen+09): size = **1" ≈ 0.05 pc**

## The central dark mass

- Astrometric measurements of close stars → central mass.
- Sgr A* ≈ **SMBH of 4.3 $10^6$ $M_\odot$,** $\theta_{\mathrm{app,Sch}}$ ≈ **50 $\mu$as**



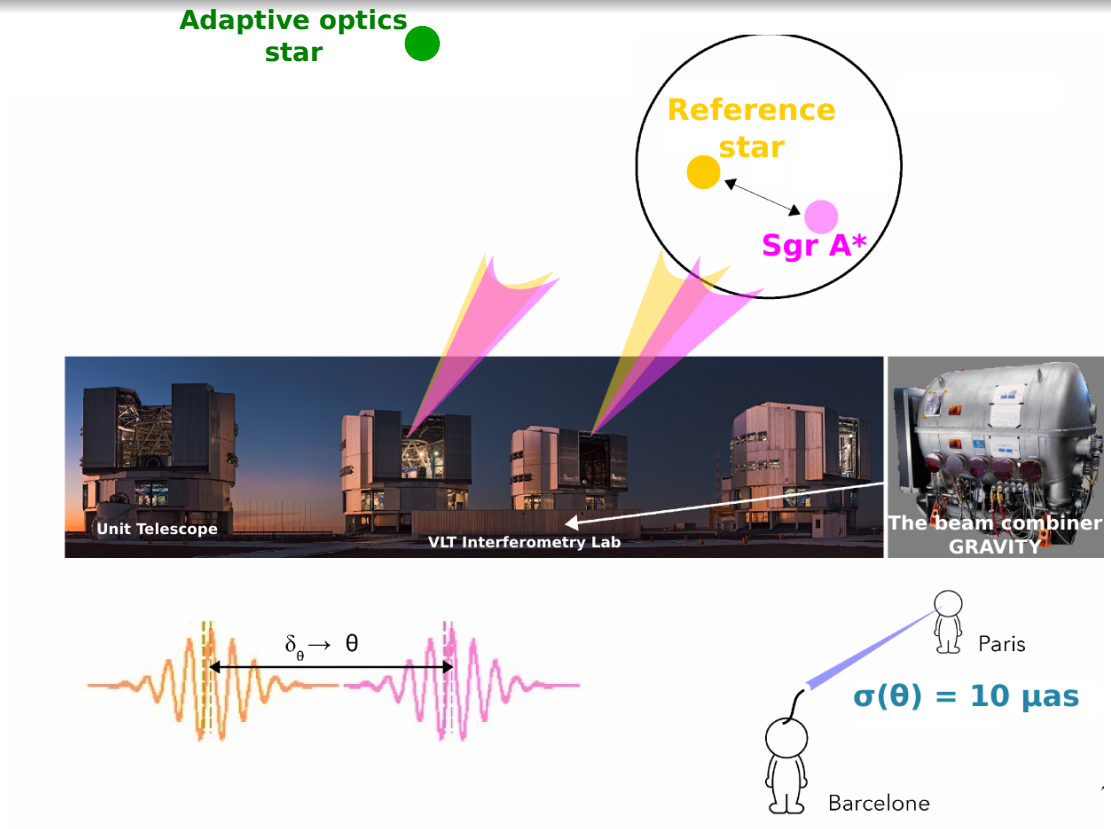

Source : Genzel et al. 2003




Source : Hamaus et al. 2009

## Sgr A* flaring state

- Flare = outbusrst of radiation, lasts $\approx 1h$, quasiperiodic (?)
- Very debated origin




**GRAVITY (2016+)**

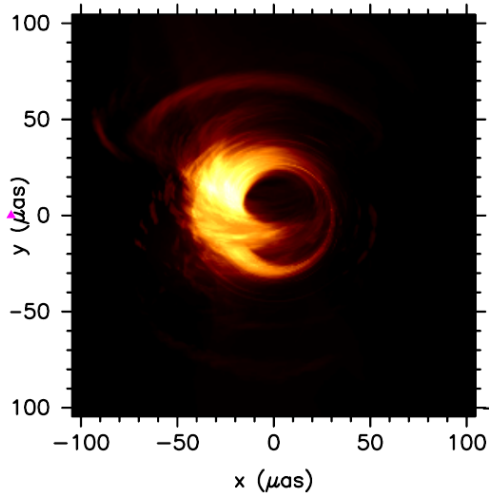
Courtesy M. Gould

## Stars follow-up + hot gas motion

- GRAVITY: **30 $\mu$as** astrometric precision (NIR; $\approx 2.2\,\mu$m)
- Goal: follow the motion of **stars** / **flares** around Sgr A*

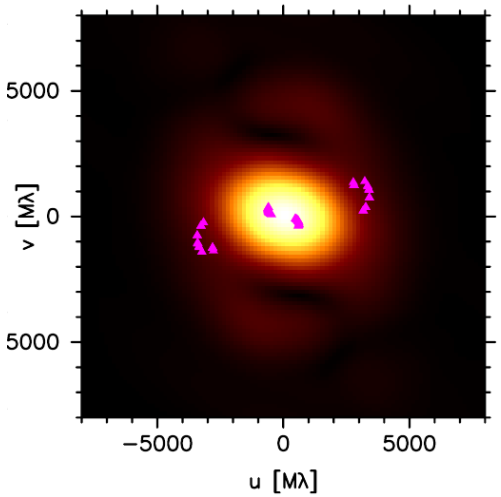
$\rightarrow$ GRAVITY Collaboration 2017 *A&A 602 A94*

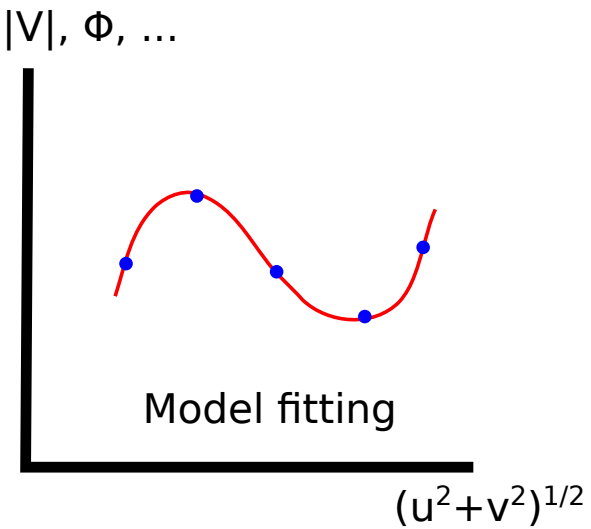
Image: I(x,y)
*sky plane*



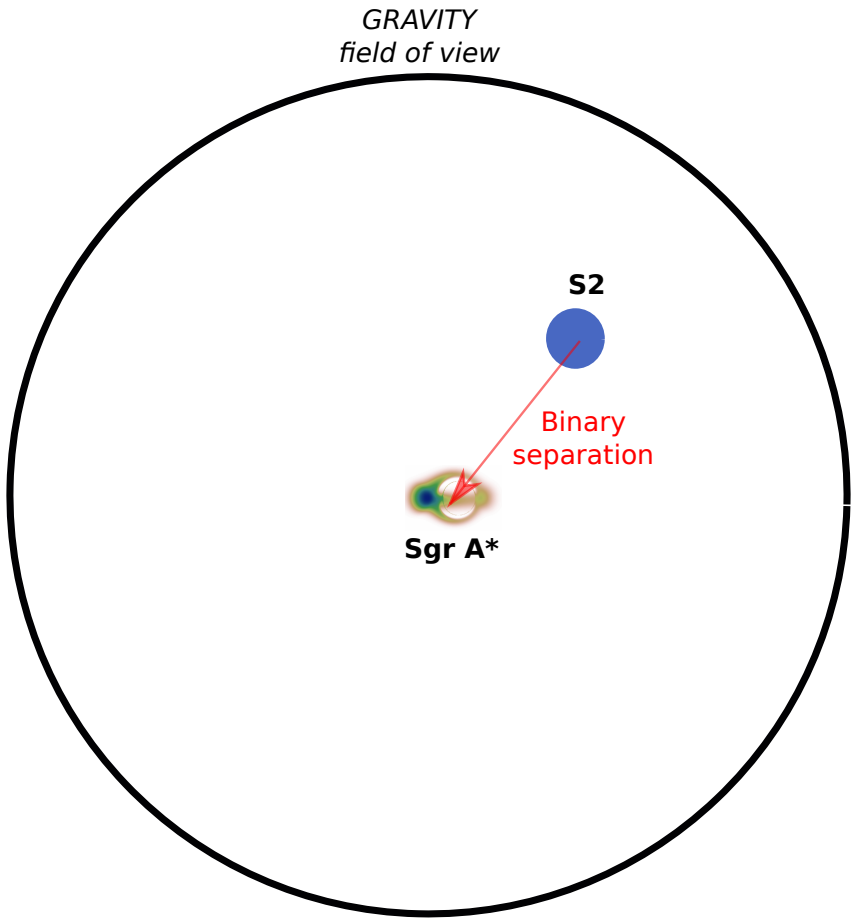

Moscibrodzka+14

FT: V(u,v)
*uv plane*

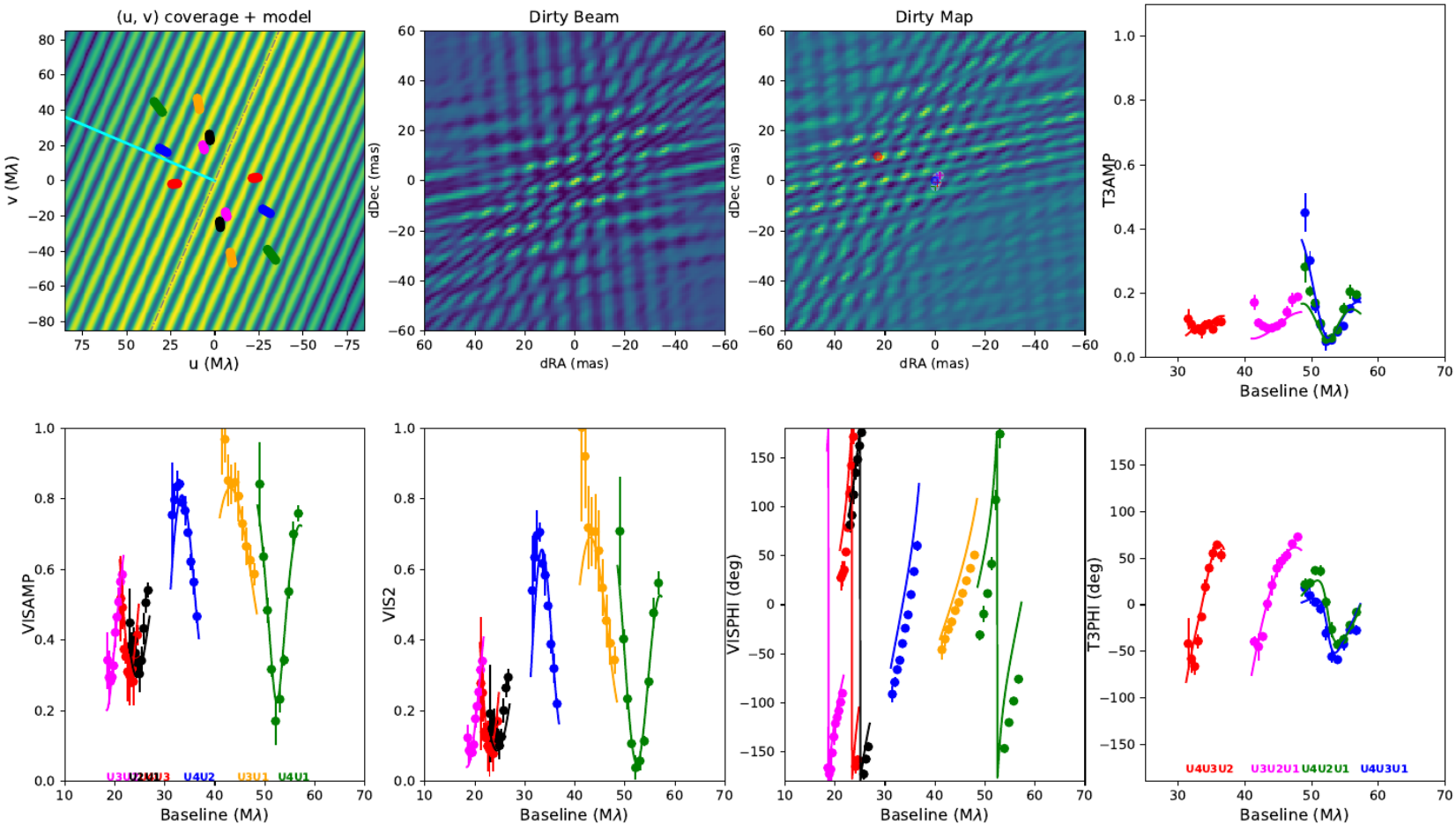


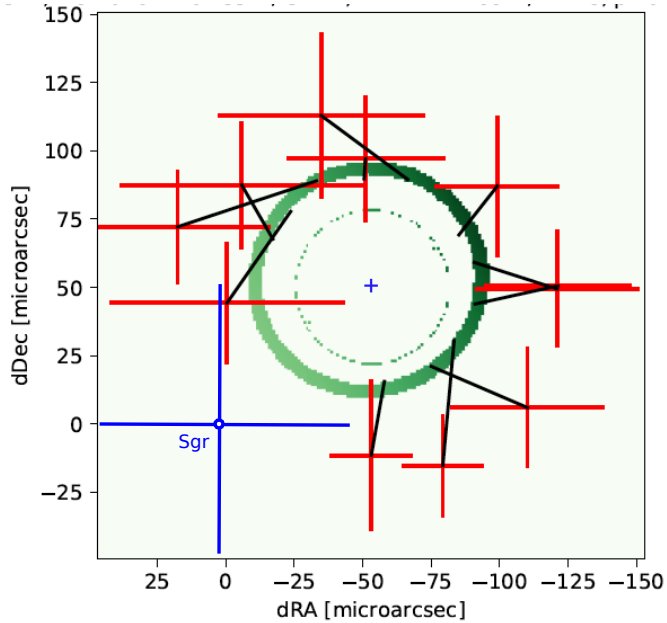

## GRAVITY data fitting




## Our model: the Sgr A* - S2 binary




# Binary fit to July 2018 flare data

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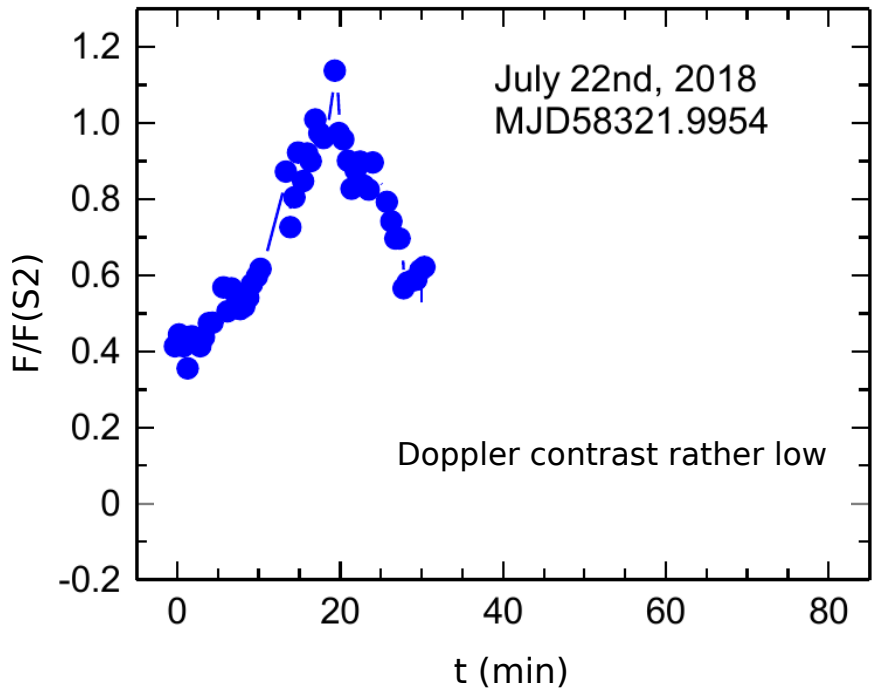
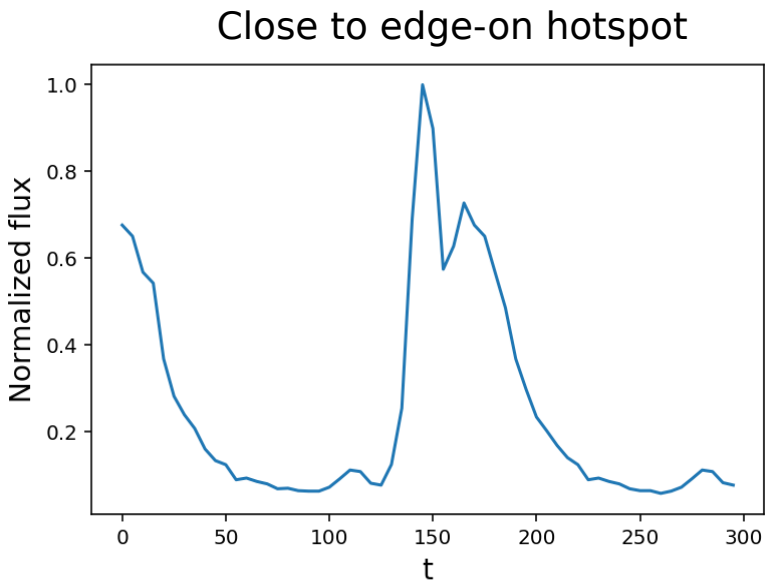
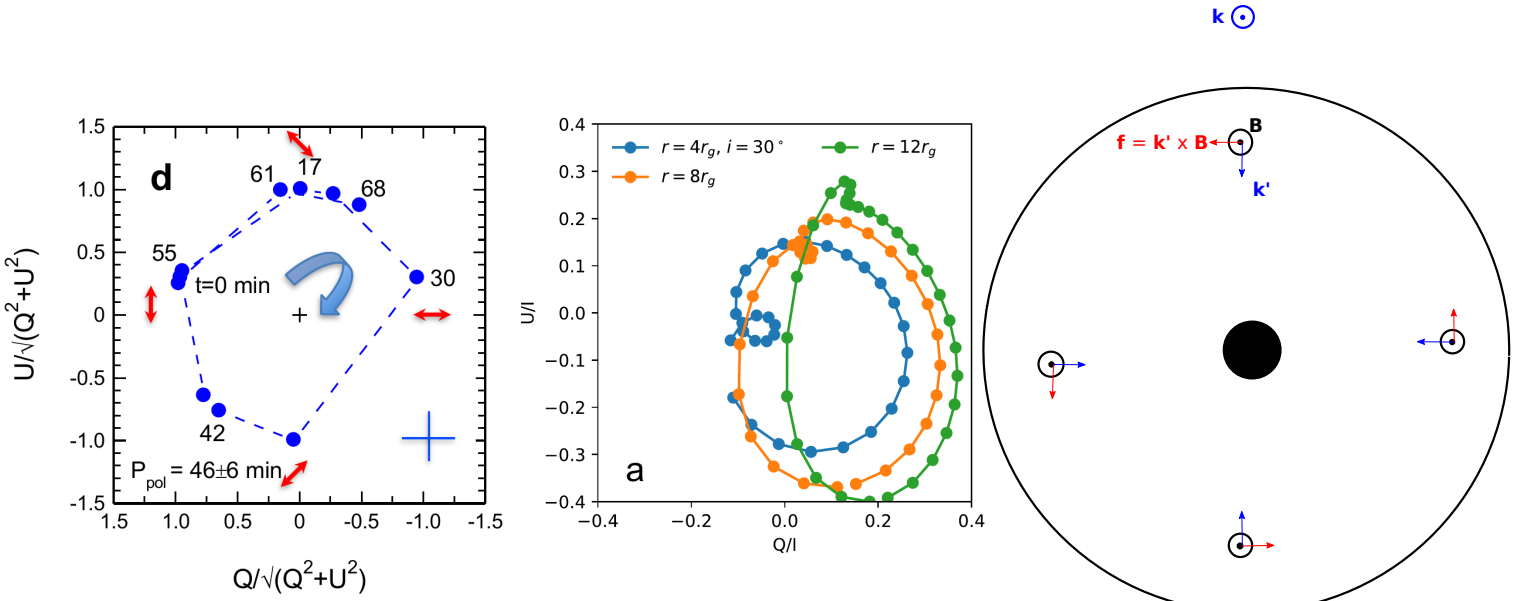
## Orbital motion at the horizon (July 22 2018)

- Flare of July 22: $\Delta t = 30$ min, Flux $m_K = 14.5$ (quiescence: $m_K = 17$)
- Flare location **coincident with Sgr A***
- Motion consistent with **GR circular orbit at** $r \approx 7\,M$ **at spin** 0 with **low inclination** favored $\approx 20°$ (no spin constraint)




## Light curve (July 22 2018): low inclination

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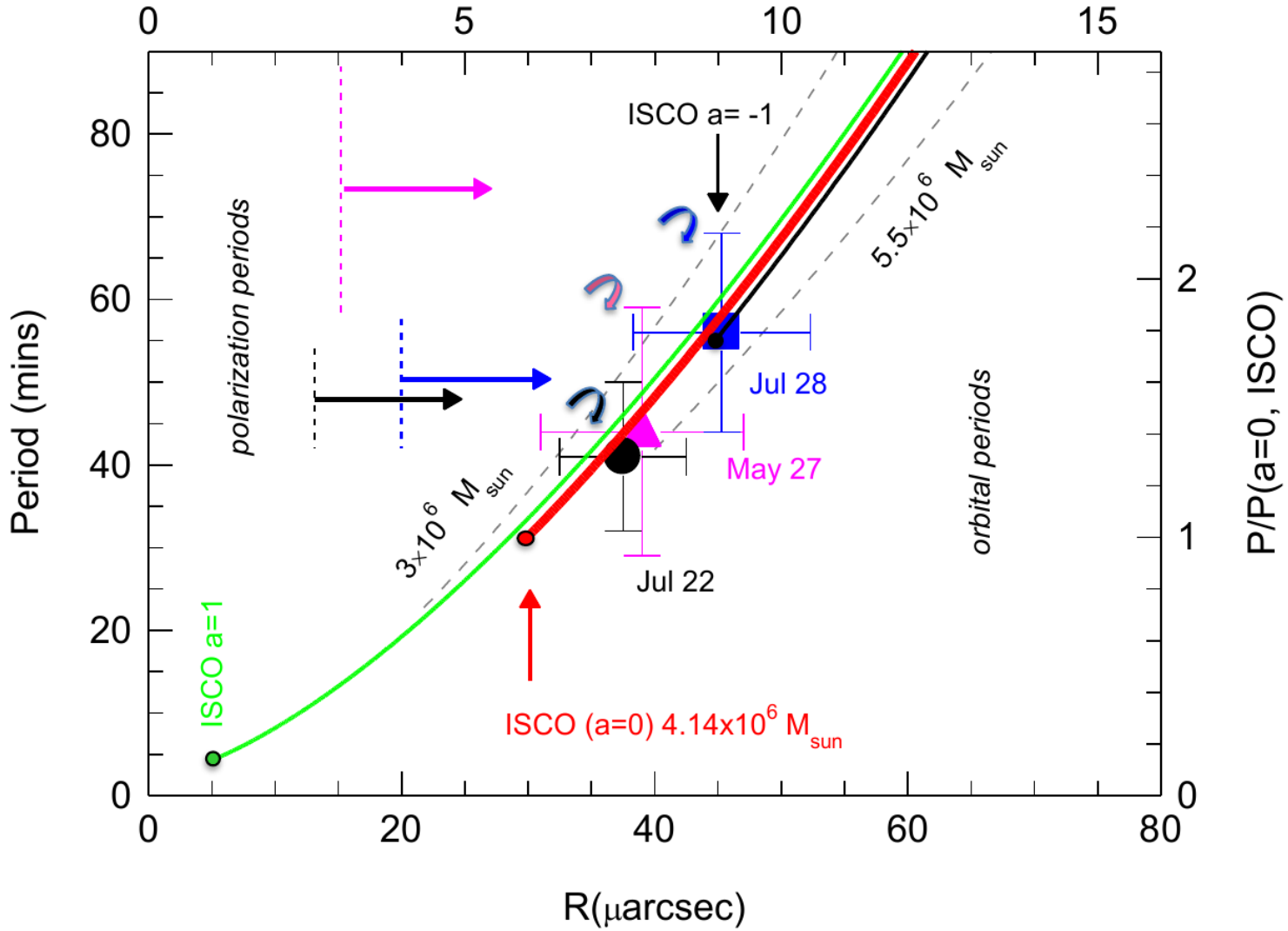
## Polarization loop (July 28 2018)

- Consistent with low inclination + poloidal field

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## The three 2018 flares

## Conclusion

- Era of routine strong-field electromag observation starting
- Wealth of information on innermost accretion flow
- GRAVITY / EHT combined look at Sgr A* very promising