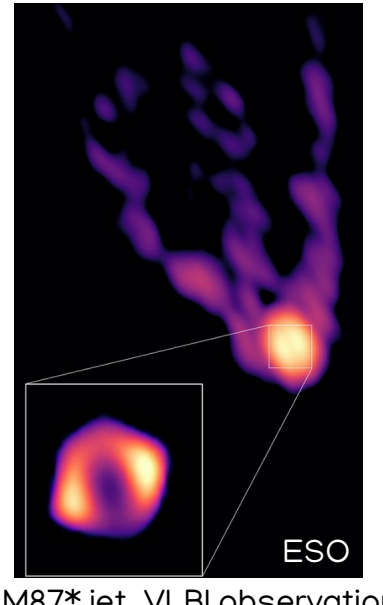
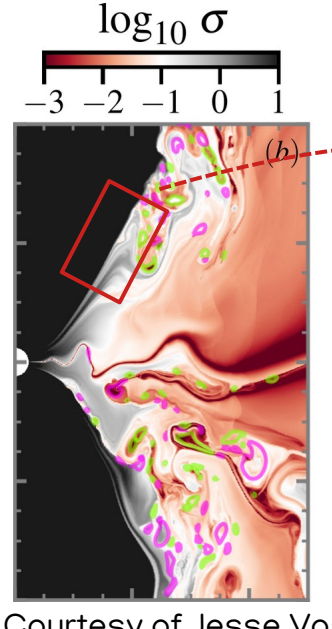
PIC Simulations of Sheared Asymmetric Relativistic Magnetic Reconnection

Enzo Figueiredo, 1st year PhD

Strong discontinuity of plasma properties at BH disk–jet interface



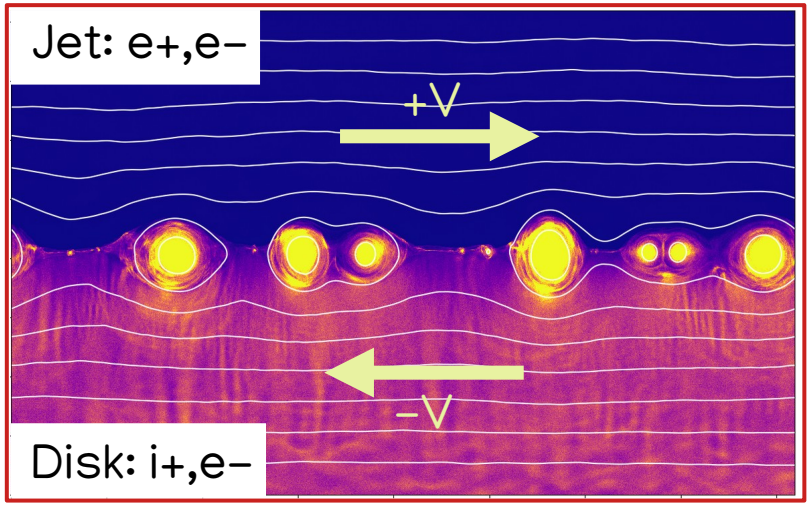
M87* jet, VLBI observation



Courtesy of Jesse Vos

How is particle acceleration affected by an asymmetric setup ?

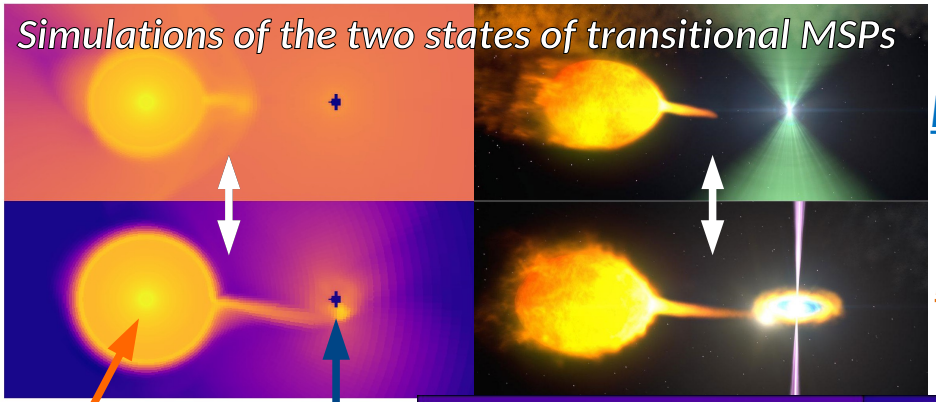
Local study of a magnetic reconnection process

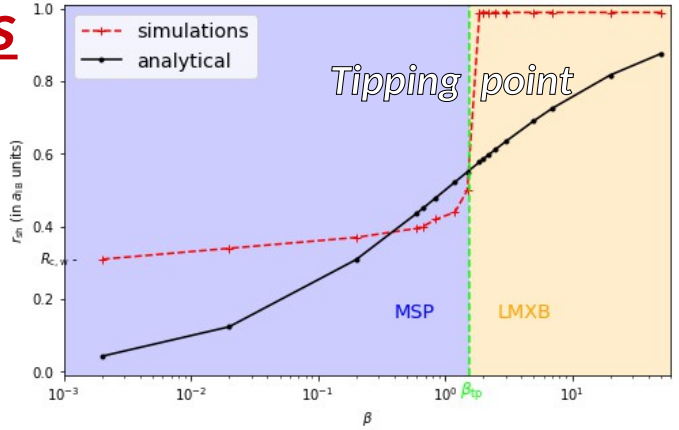


Highlights:
- the disk particles get most of the EM energy
- shear slows and quenches the reconnection

Future work:
- extension to a global model

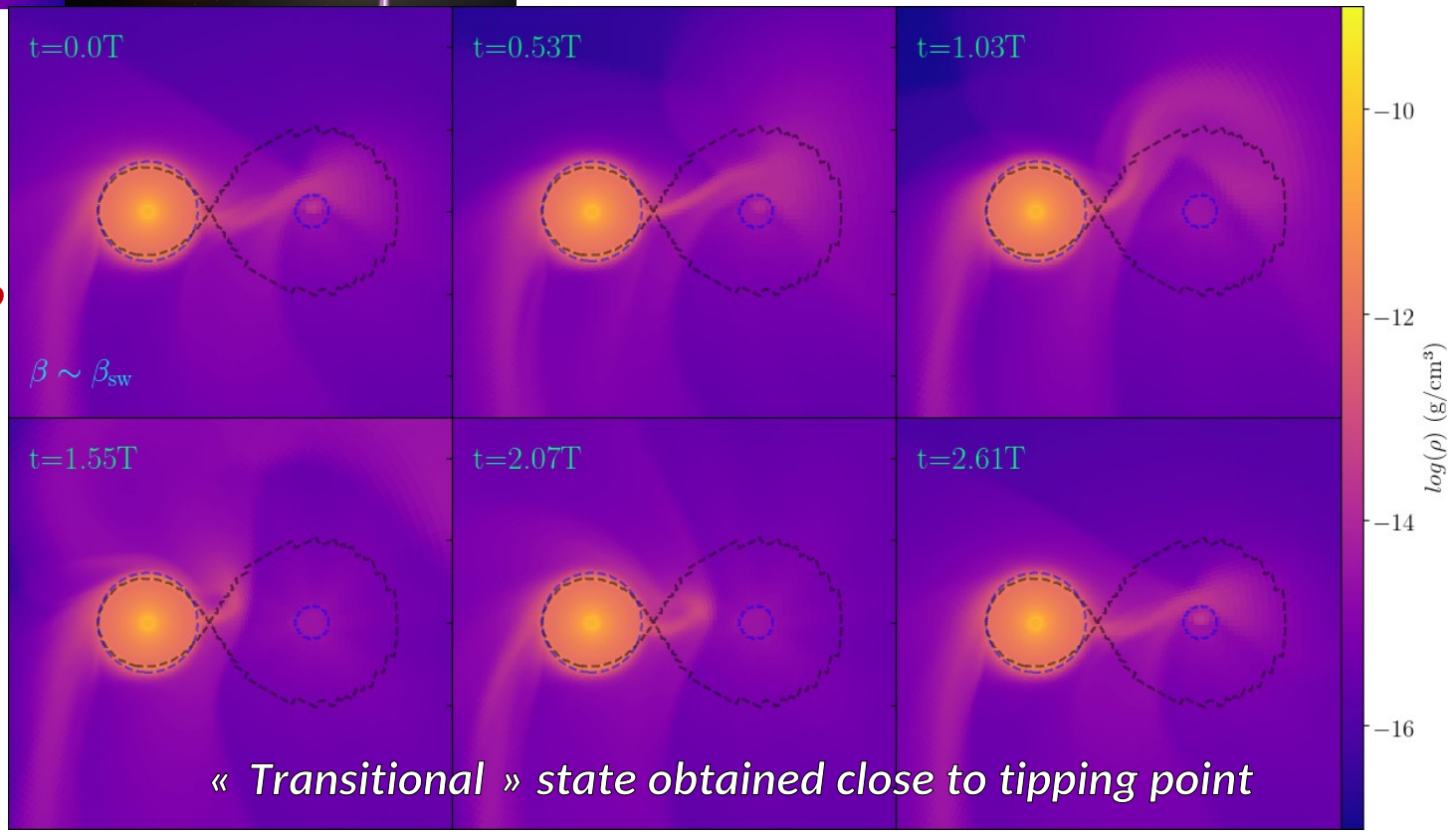
Impact of gravity and tipping point of transition between MSP and LMXB states in spider systems





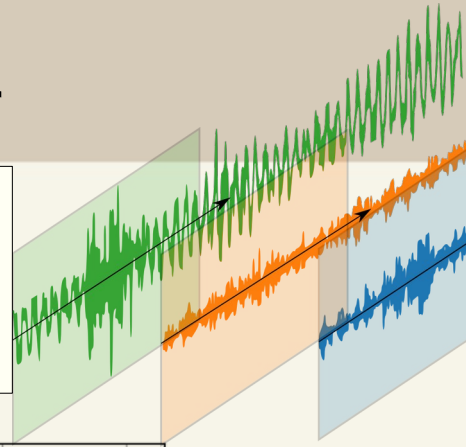
Momentum fluxes ratio

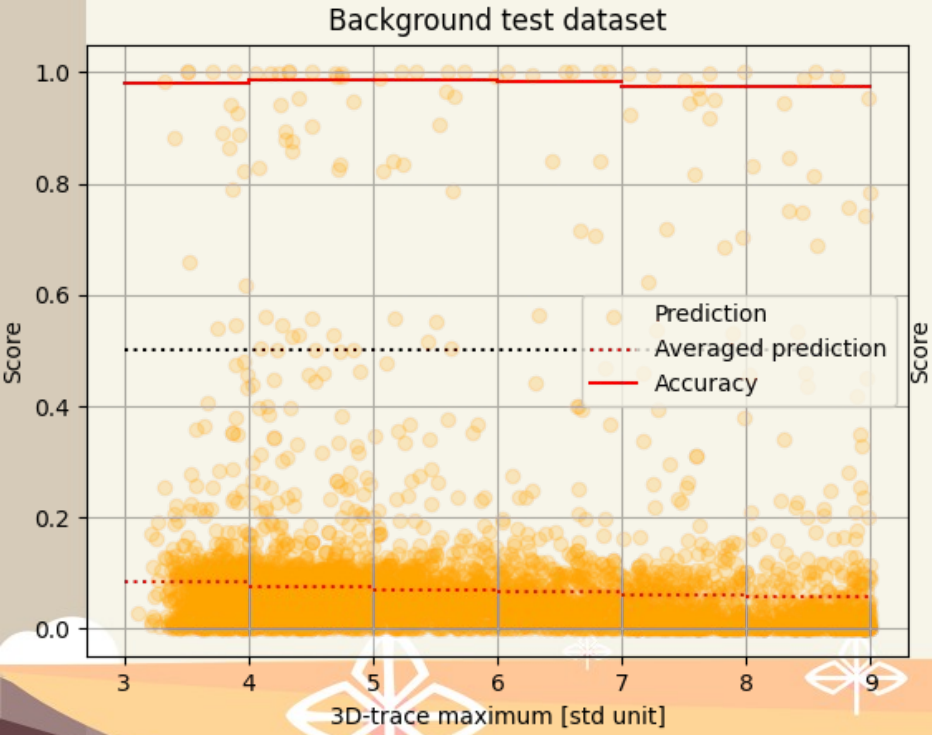
$$\beta = \frac{\dot{m}_c v_c}{\dot{m}_{psr} v_{psr}}$$

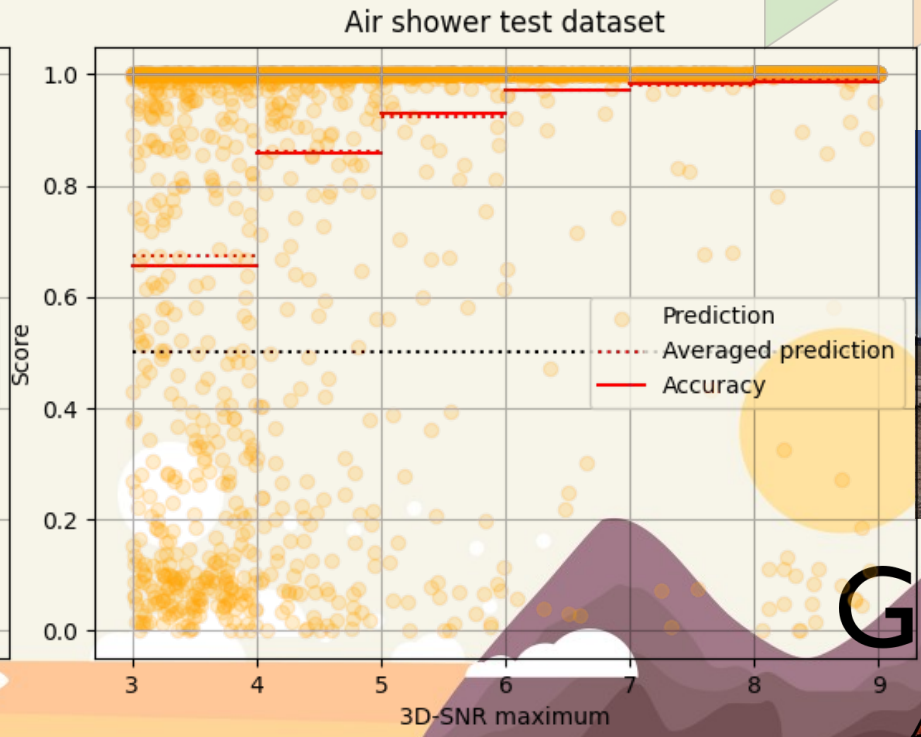


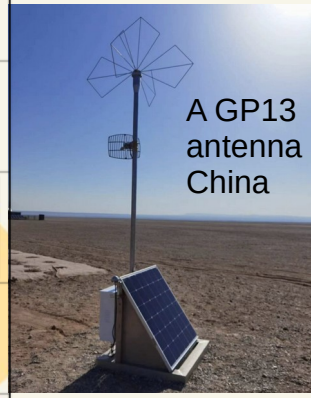
GRAND *Giant Radio Array for ν Detection* First Level Trigger

Autonomous detection of **UHE ν** -induced air-showers via antenna arrays
→ need a smart trigger to discriminate **background/air shower** radio signals with high purity
→ convolutional neural network trained/tested with GP13 data (experimental + simulated)
→ background transient rejection ~98 %, air shower transient selection > 86 % for SNR > 4
→ to be implemented on elec. board and tested in lab.(ressource)/on the field(sim. artifact?)

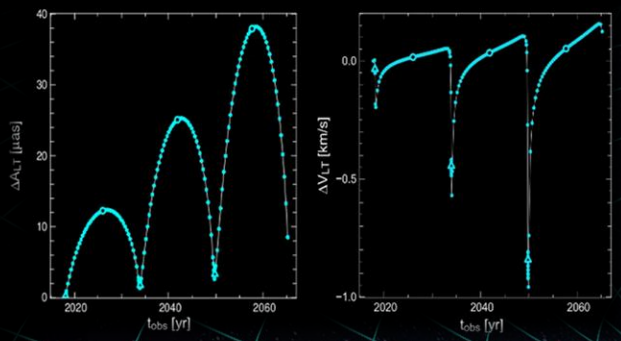








RELATIVISTIC EFFECTS ON THE ORBITS OF THE CLOSEST STARS TO THE BLACK HOLE AT THE CENTER OF THE GALAXY



Detected spin with S2 after 47yr with an error of $1\sigma = 0{,}1$

↳ Possible spin detection with S2/10 in <1yr

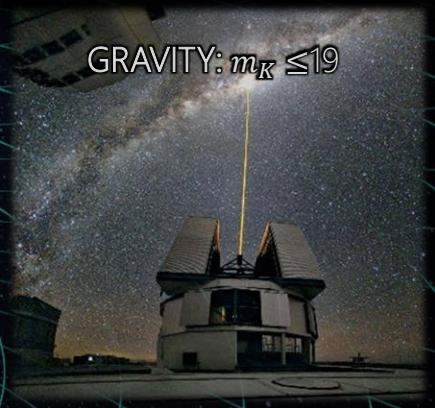
Mass = $4.3 \times 10^6 M_\odot$

Spin = ?

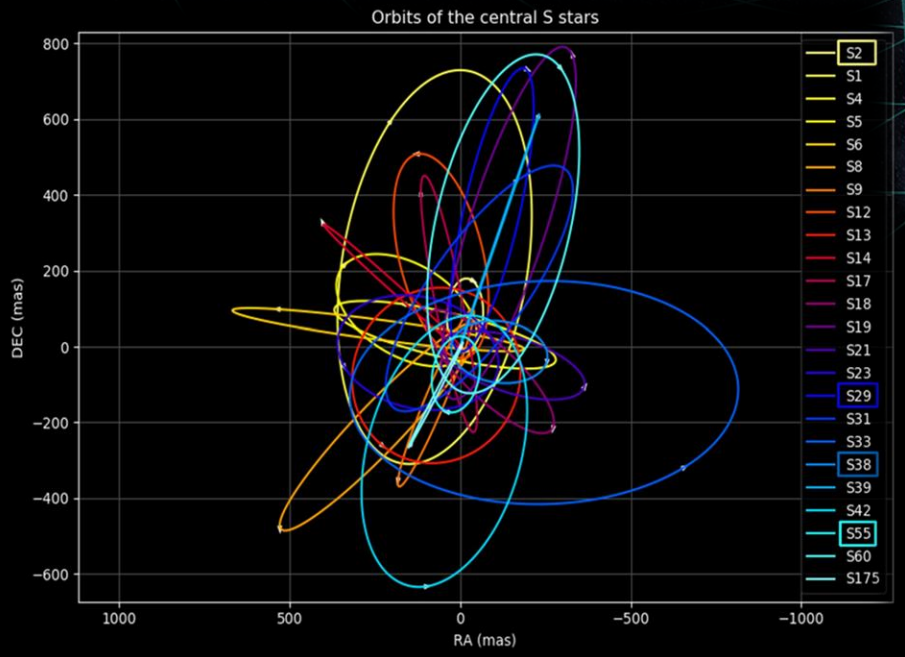
Quadrupole moment = ?

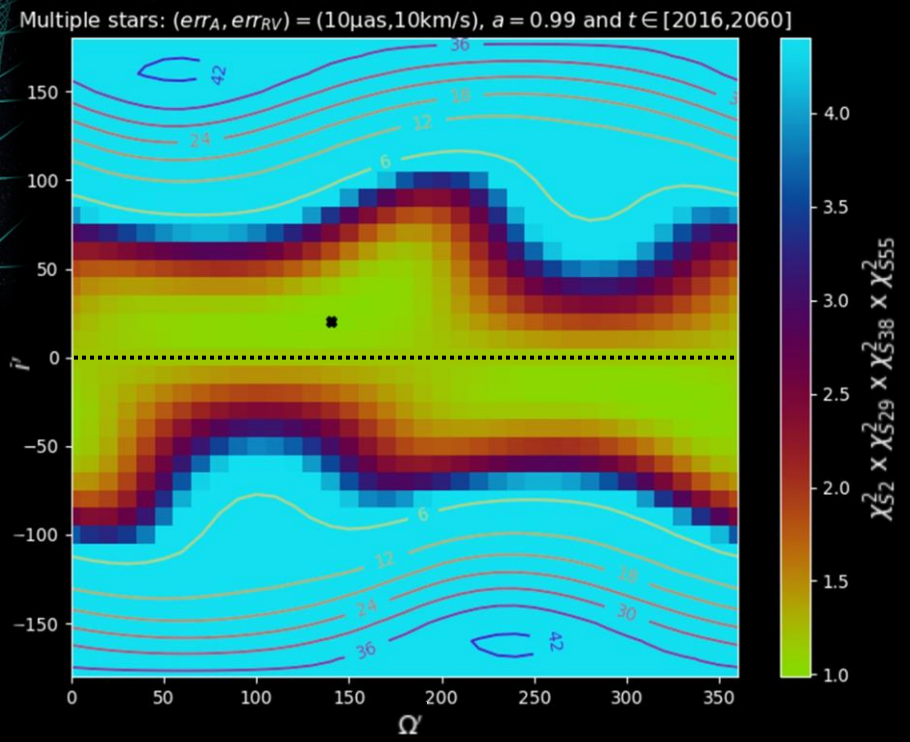
Orbit of S2 (period: 16 yr)

Sgr A*



↳ GRAVITY +: $m_K \leq 22$





Lorentz Invariance Violation and gamma-ray astronomy - Status and prospects

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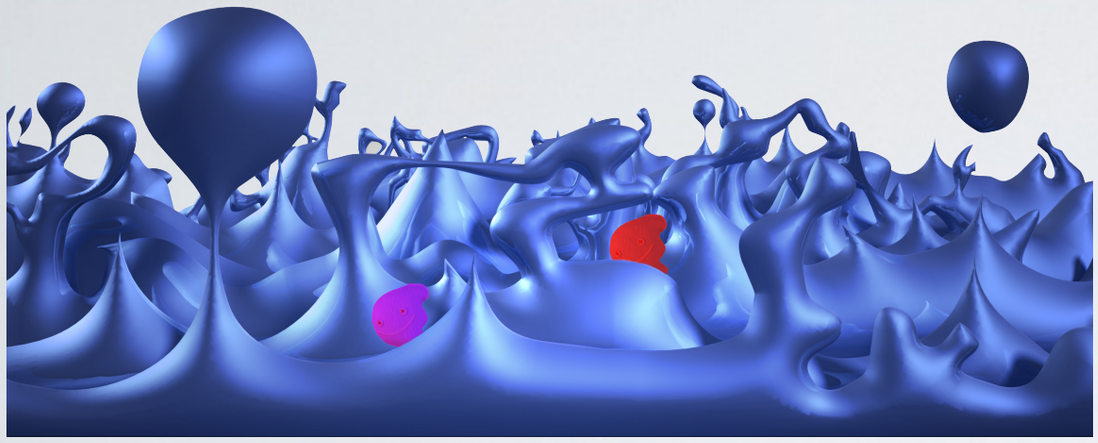
S. Caroff, D. Kerszberg, C. Levy,
U. Pensec, C. Perennes,
C. Plard, A. Rosales de Leon, H. Sol



Quantum Gravity space time foam

Production and acceleration mechanisms

Energy Dependent time delays

$$\Delta t_{\rm meas} = \Delta t_{\rm int} + \Delta t_{\rm LIV} + ...$$

Propagation effect

Varies with source distance

Tests with keV-GeV GRB, AGN, PSR data

$\Delta t_{\rm LIV} \sim 0$ s/TeV

* $E_{\rm QG} > {\rm E_P} \sim 10^{19}$ GeV

*** $E_{\rm QG} > 10^{17}$ GeV

Source intrinsic effect

Do not vary with distance

AGN **Modeling** for now purely leptonic

$\mathcal{O}(-100 \text{ s/TeV}) < \Delta t_{\rm int,mod} < O(100 \text{ s/TeV})$

Lags strongly correlated in X and gamma
SIE ➞ a new way to constrain models

$\Delta t_{\rm meas} \sim 0$ s/TeV

Need to be tested with more sources up to TeV energies ➞ CTA

Joint Working Group
H.E.S.S./MAGIC/VERITAS/LST1

Bolmont et al. 2022

Need for population studies

Combined constraints

Need to be compared with data and extended to GRBs ➞ CTA

Joint Working Group
LPNHE/LUTh

Perennes et al. 2021, Levy et al. (ICRC + in prep.)