

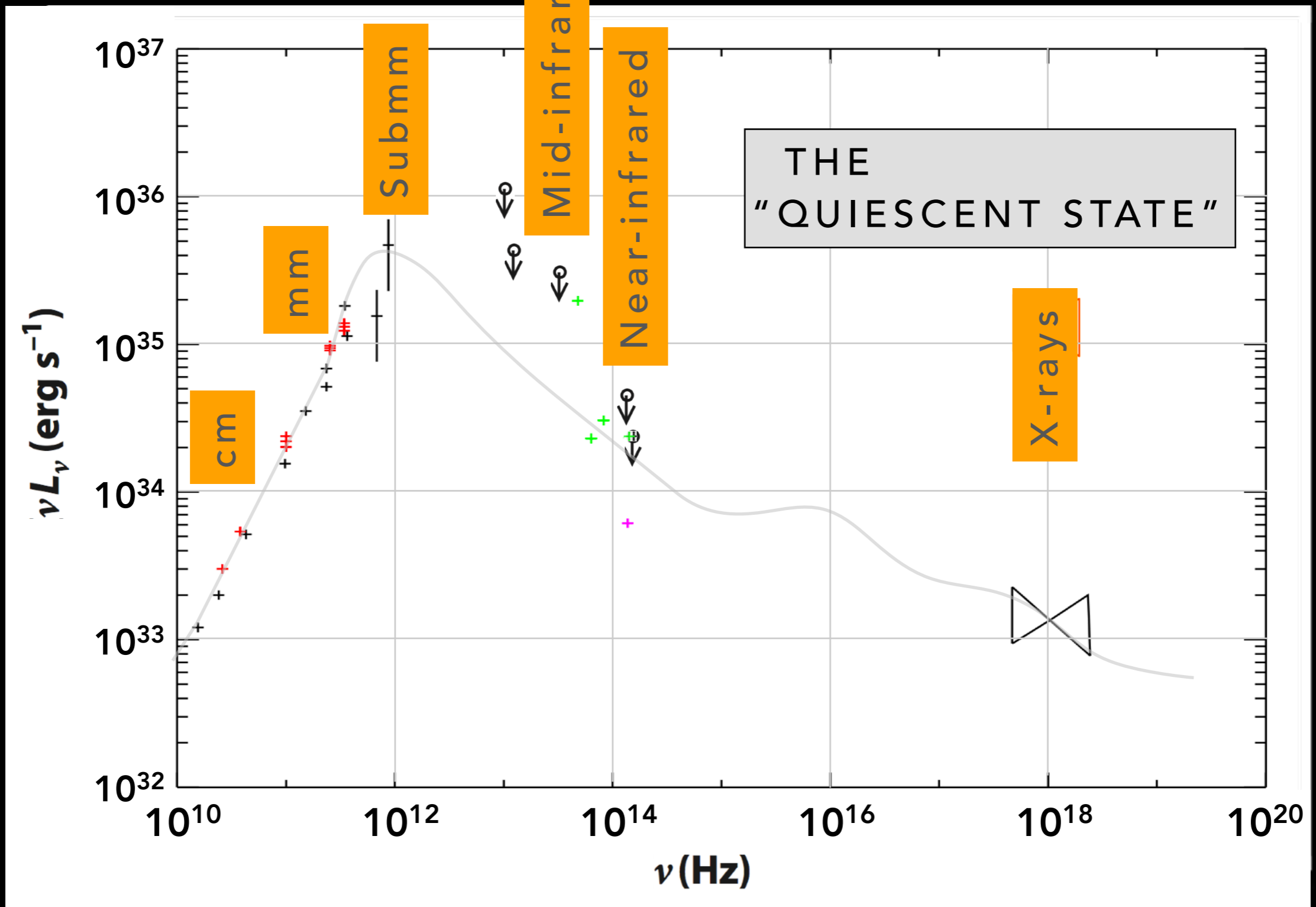


MAX-PLANCK-INSTITUT FÜR
EXTRATERRESTRISCHE PHYSIK

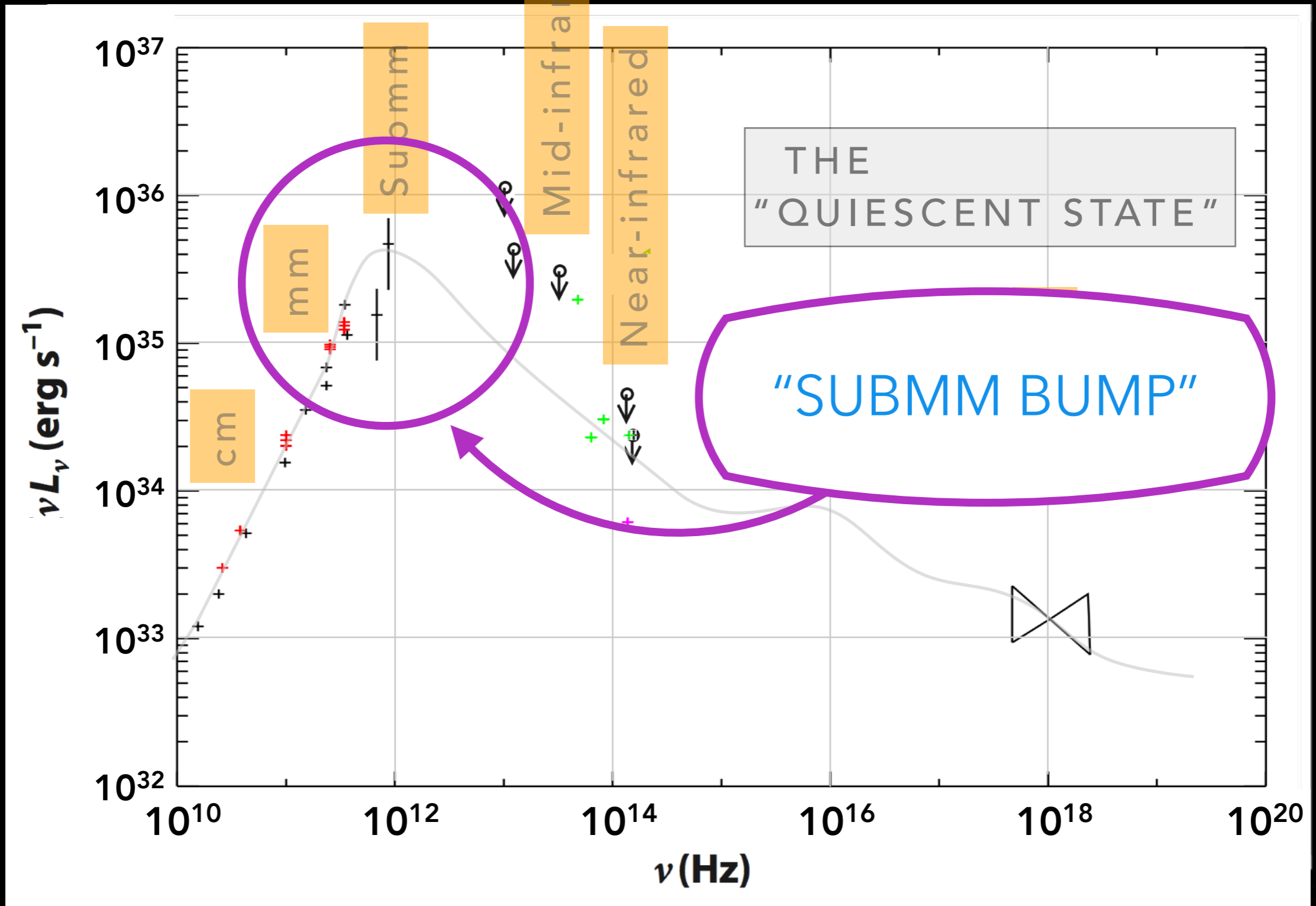
IMPACT OF FARADAY
EFFECTS ON EVENT
HORIZON SCALE GRMHD
IMAGES OF SGR A*

ALEJANDRA JIMÉNEZ ROSALES
JASON DEXTER

THE SED OF SGR A*.

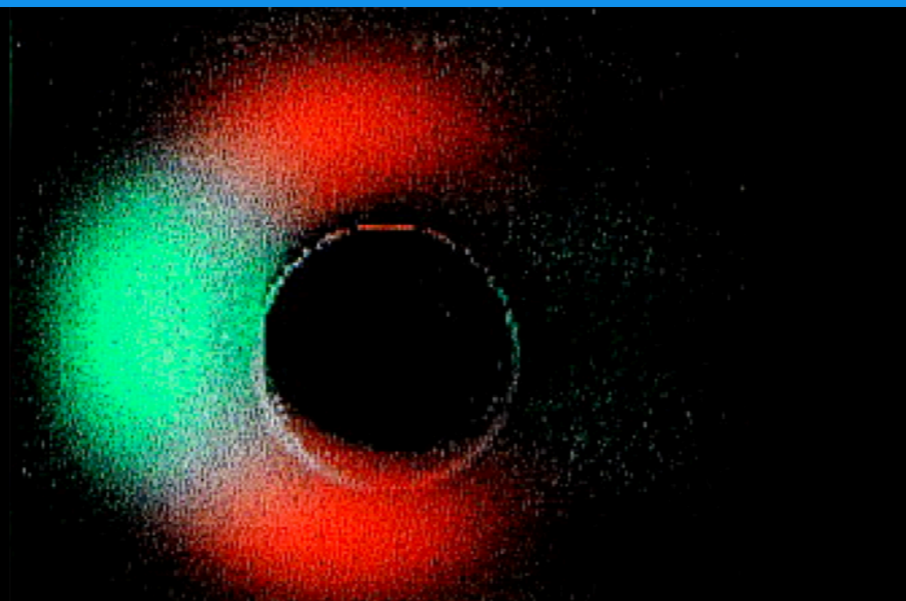
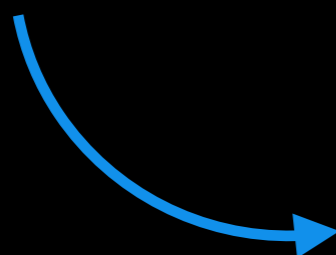


THE SED OF SGR A*.

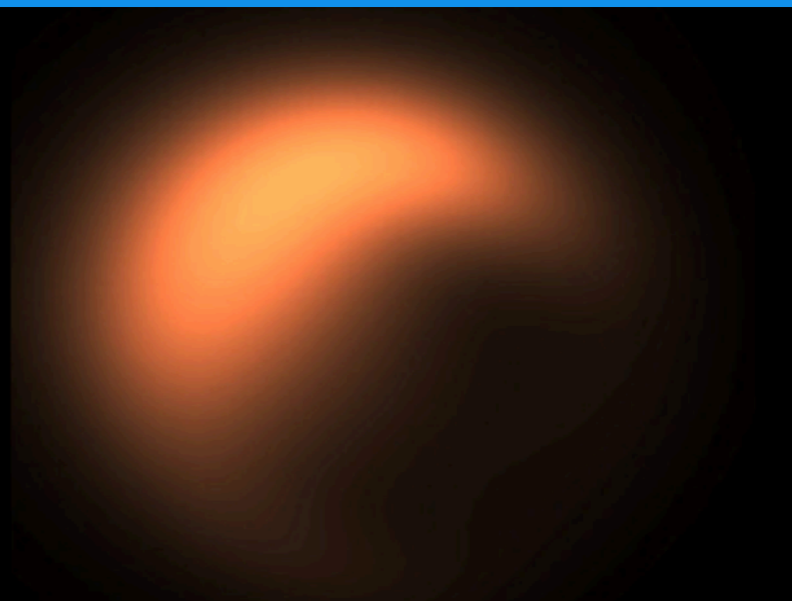


SOME MODELS FOR THE "SUBMM BUMP"

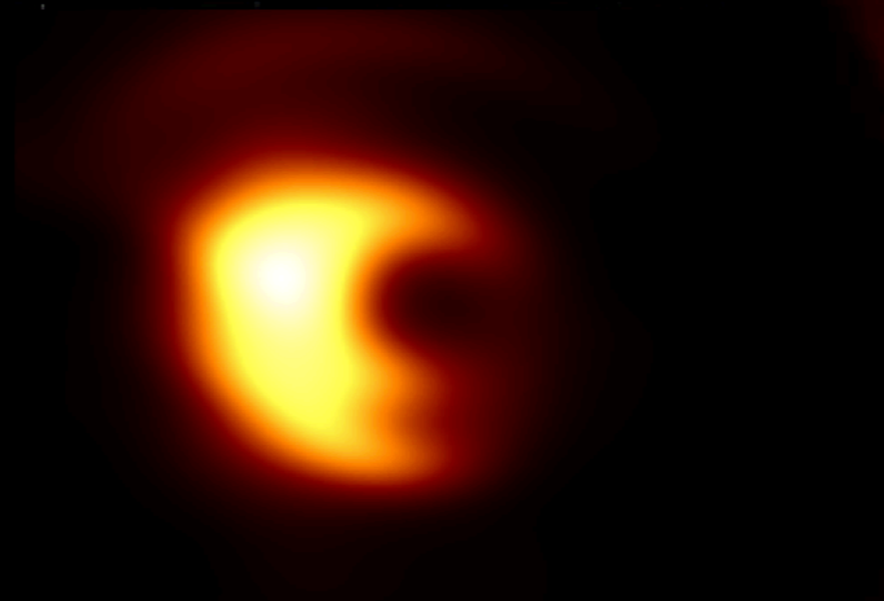
CRESCENT
SHAPES



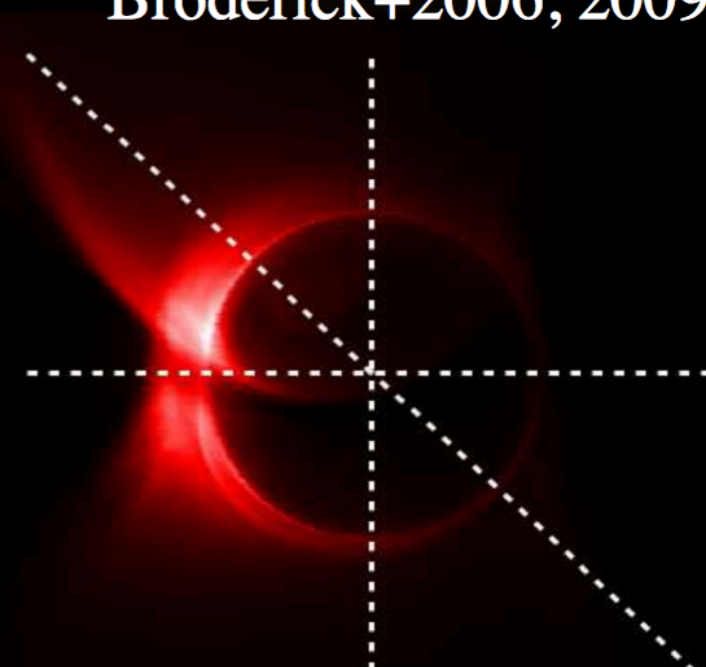
Bromley+2001



Broderick+2006, 2009



Moscibrodzka+2014



Chan, Psaltis+2015

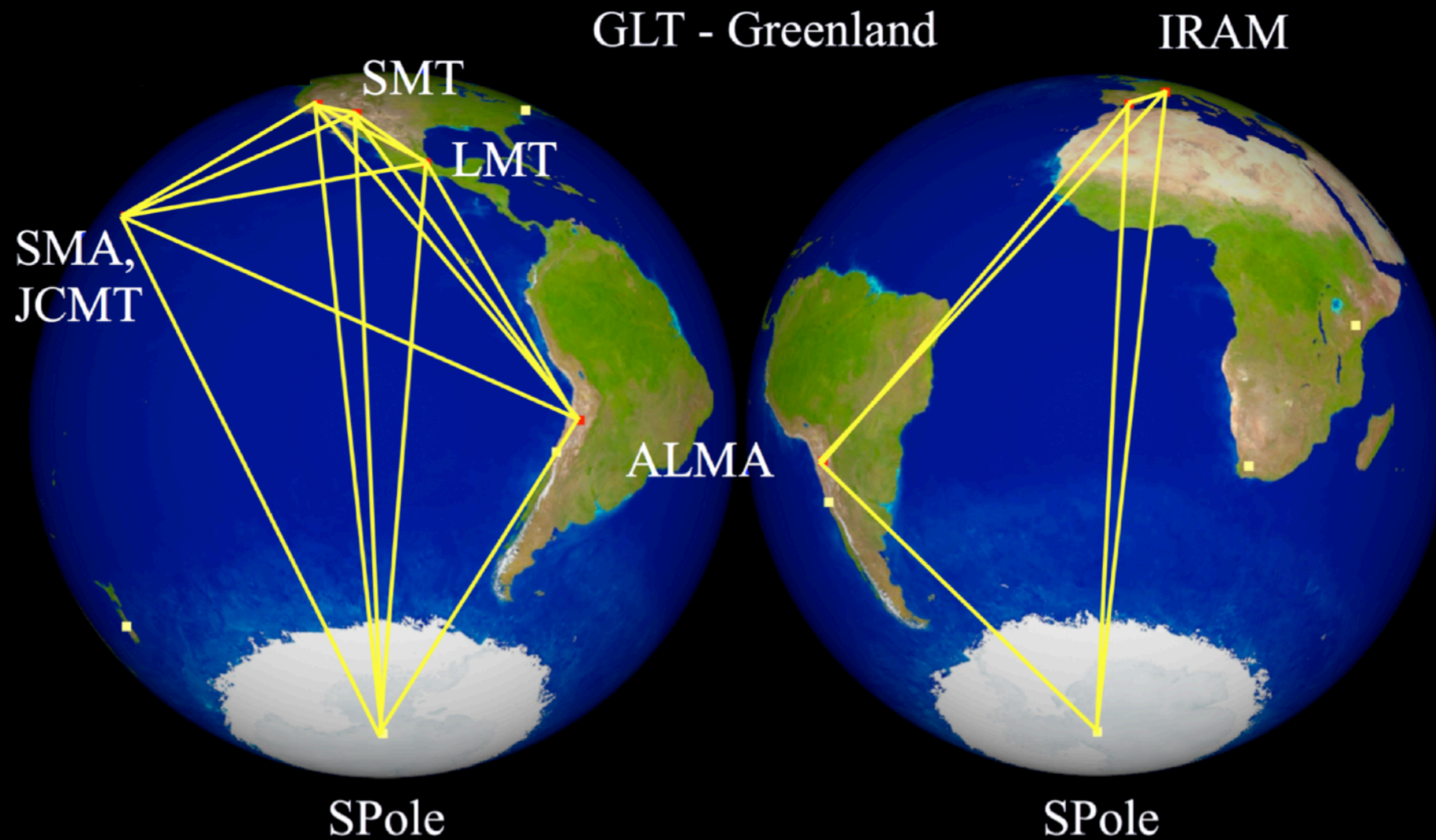
POLARISATION.

The “Submm bump” is polarised:

- **Linear polarisation fraction (LP) ~5-10%** (Aiken+2000; Bower+2002, 2003; Muñoz+2011).
- The **rotation measure (RM)** through the accretion flow is **$< 2 \times 10^6$ rad/m²** (Bower+2003; Marrone+2006, 2007).

The **LP** and **RM** are
model **bouncers**.

THE EVENT HORIZON TELESCOPE (EHT).



Sgr A*'s shadow:

$$\theta \sim 50 \mu\text{as}$$



Spatially resolved⁶

polarisation (Johnson+2015).

http://www.eventhorizontelescope.org/technology/building_a_larger_array.html

-
- How to **study** the **coherence** of a **polarisation** measurement?
 - What if we had **another quantity**, like the LP and the RM, that could help us **restrict** and maybe even **discard models** for **Sgr A***?

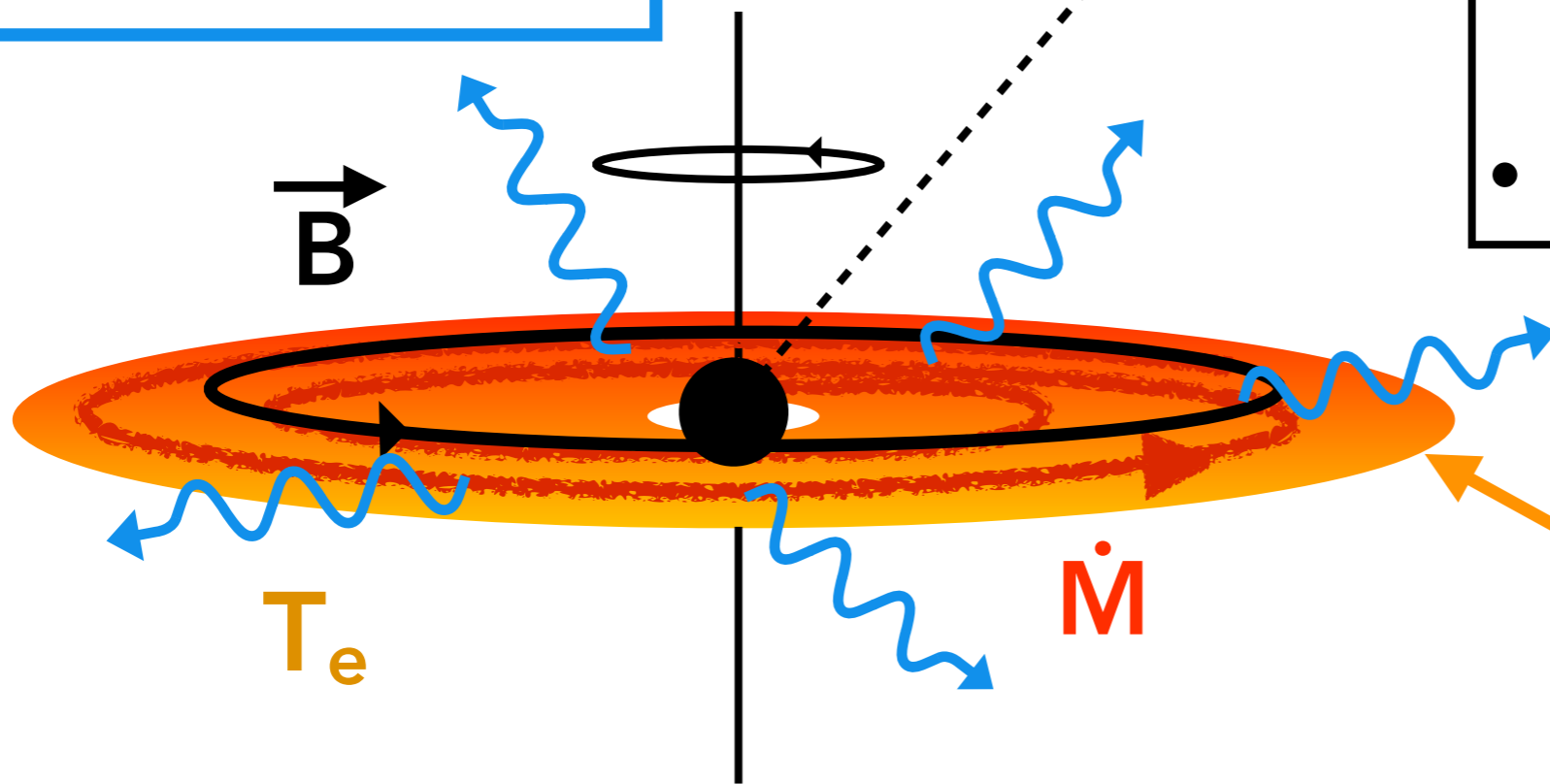
THE SYSTEM.

Parameters: (\dot{M} , T_e)

To observer

SYNCHROTRON
RADIATION

- Fixed observed frequency at 230GHz.
- Fixed flux.



FARADAY SCREEN

*Not to scale.

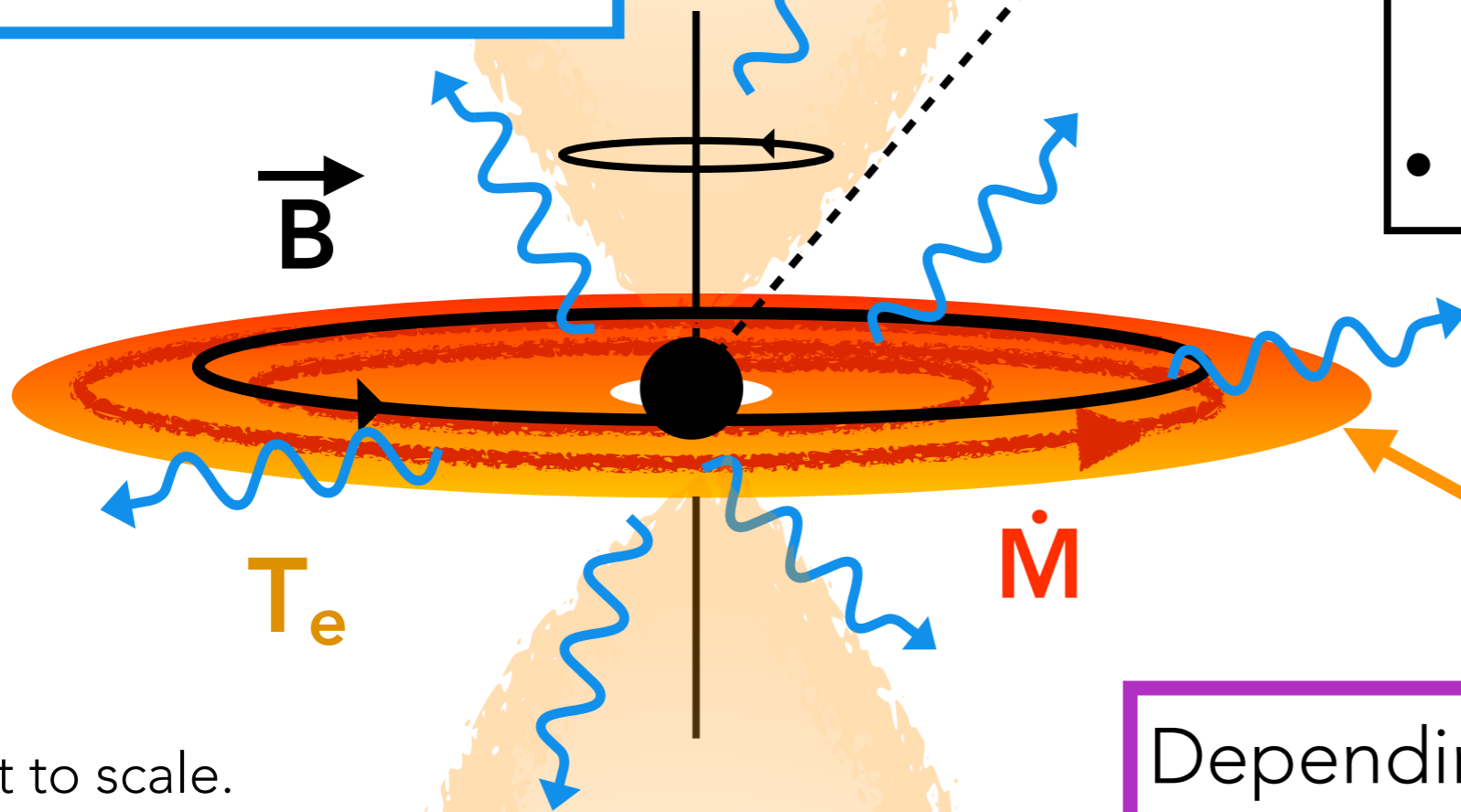
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To observer

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RADIATION

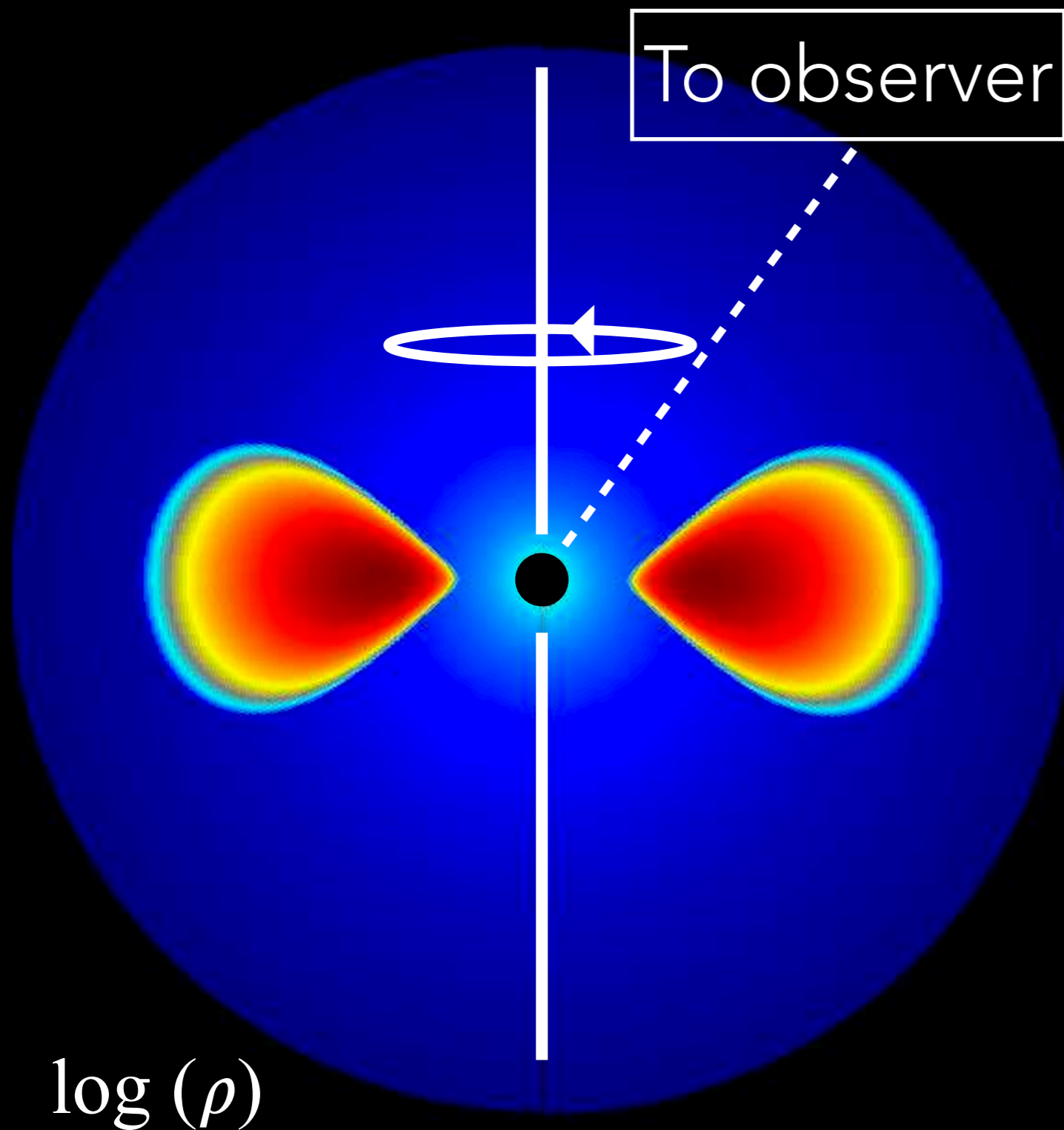
- Fixed observed frequency at 230GHz.
- Fixed flux.



*Not to scale.

Depending on \dot{M} and T_e a jet may become evident.

MODEL FOR THE "SUBMM BUMP".

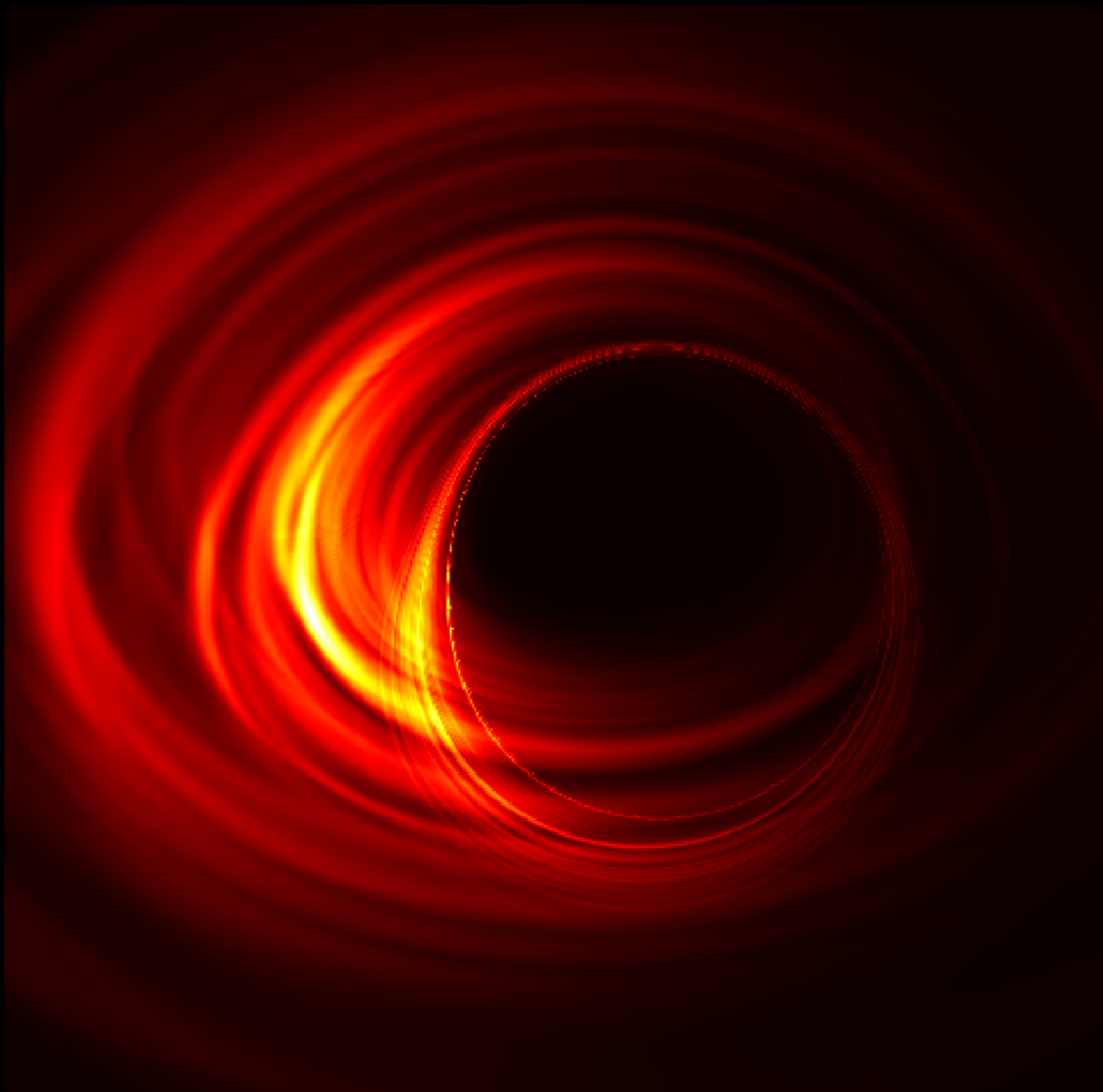


IN OUR CASE:

HARM fluid model:
accreting magnetised
plasma in a thick torus.
(Gammie+2003).

Self-consistent polarised
radiative transfer with
GRTRANS code.
(Dexter+2010, 2016).

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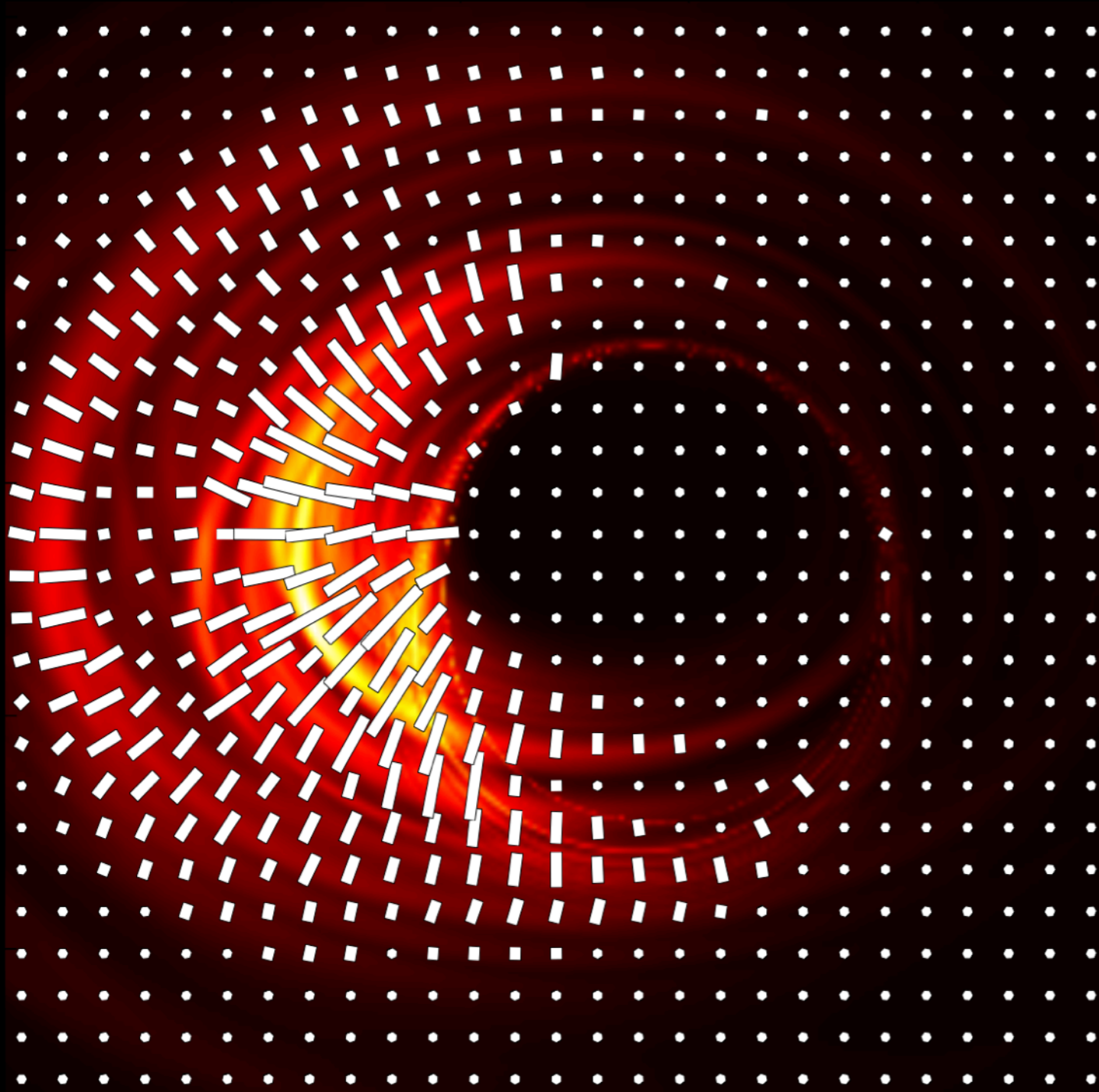


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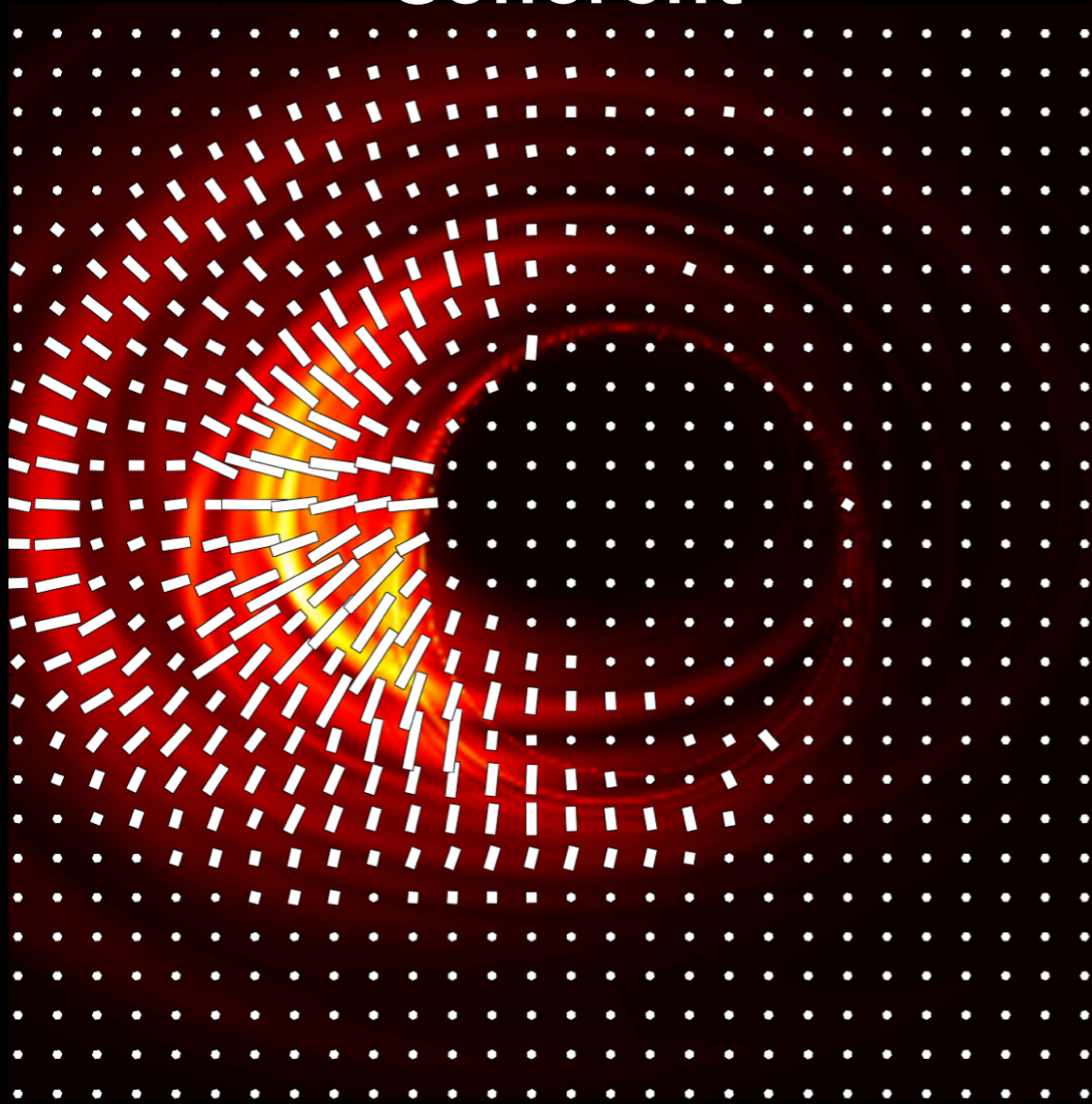
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Weak Faraday Effects

(Low $\dot{\mathbf{M}}$, high T_e)

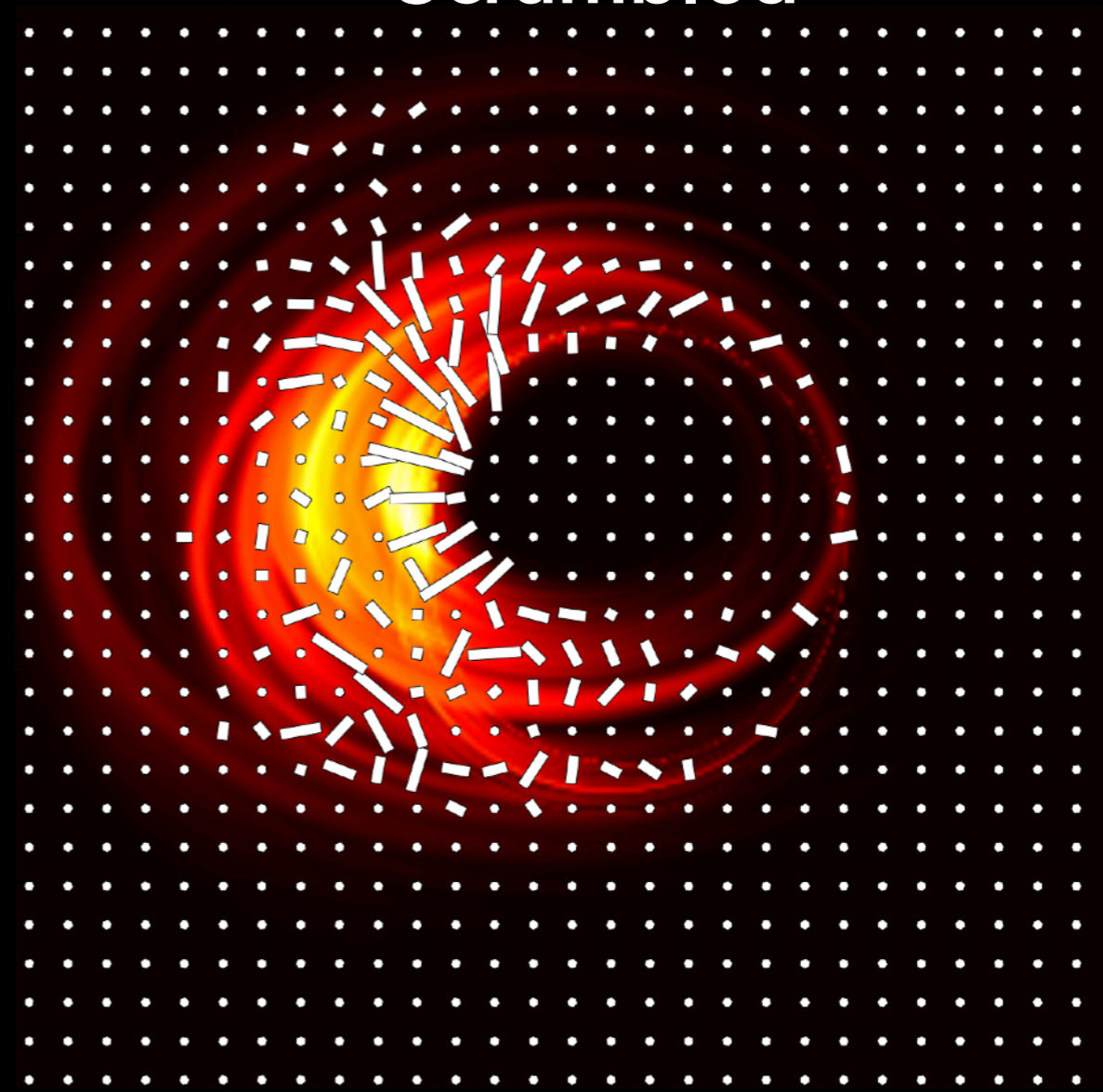
Coherent



Strong Faraday Effects

(High $\dot{\mathbf{M}}$, low T_e)

Scrambled

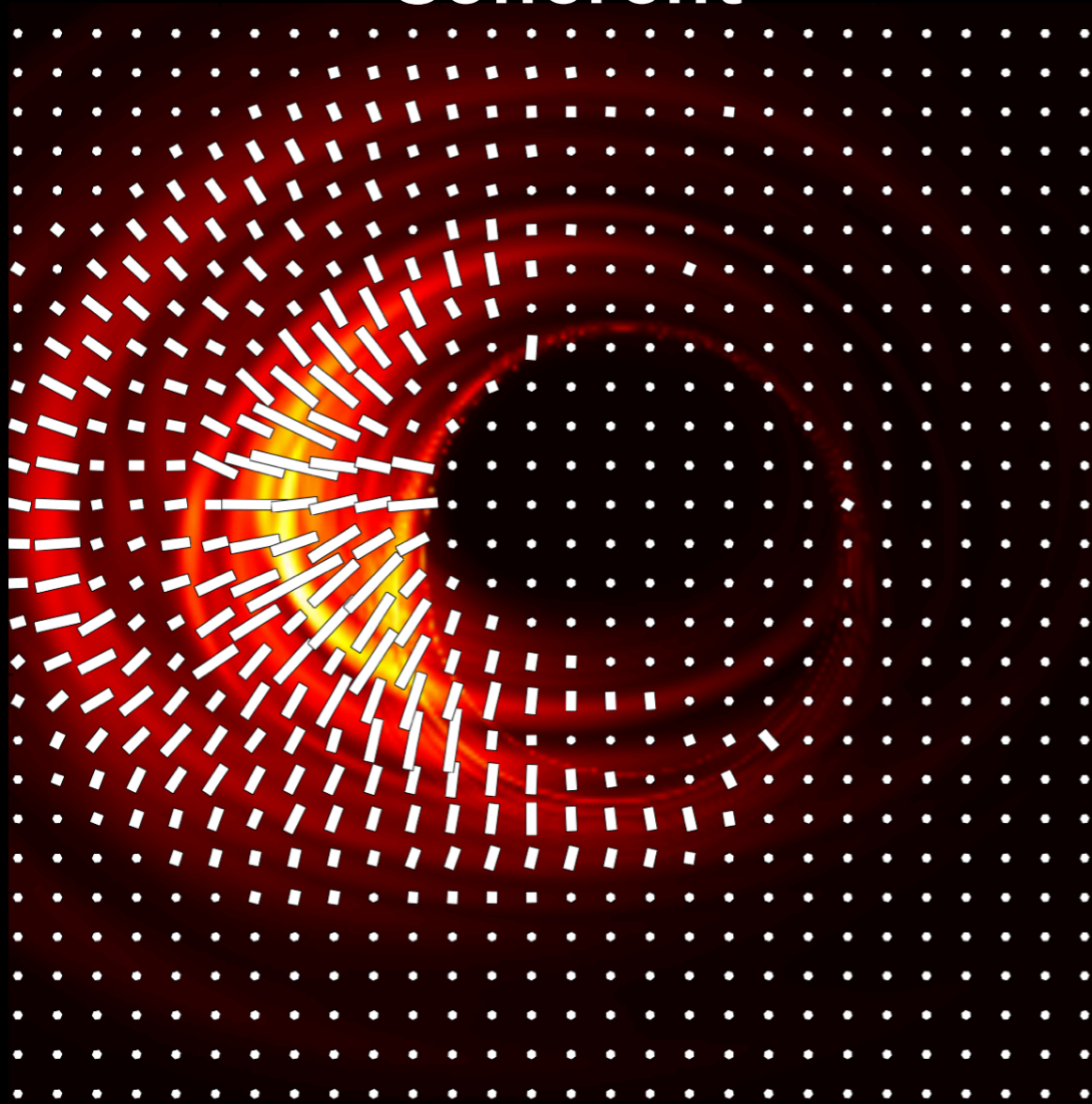


Faraday **ROTATION DEPTH**: $\tau_{\rho_V} = \int \rho_V(s) ds \propto n_e |\mathbf{B}| / T_e^2$

Weak Faraday Effects

(Low $\dot{\mathbf{M}}$, high T_e)

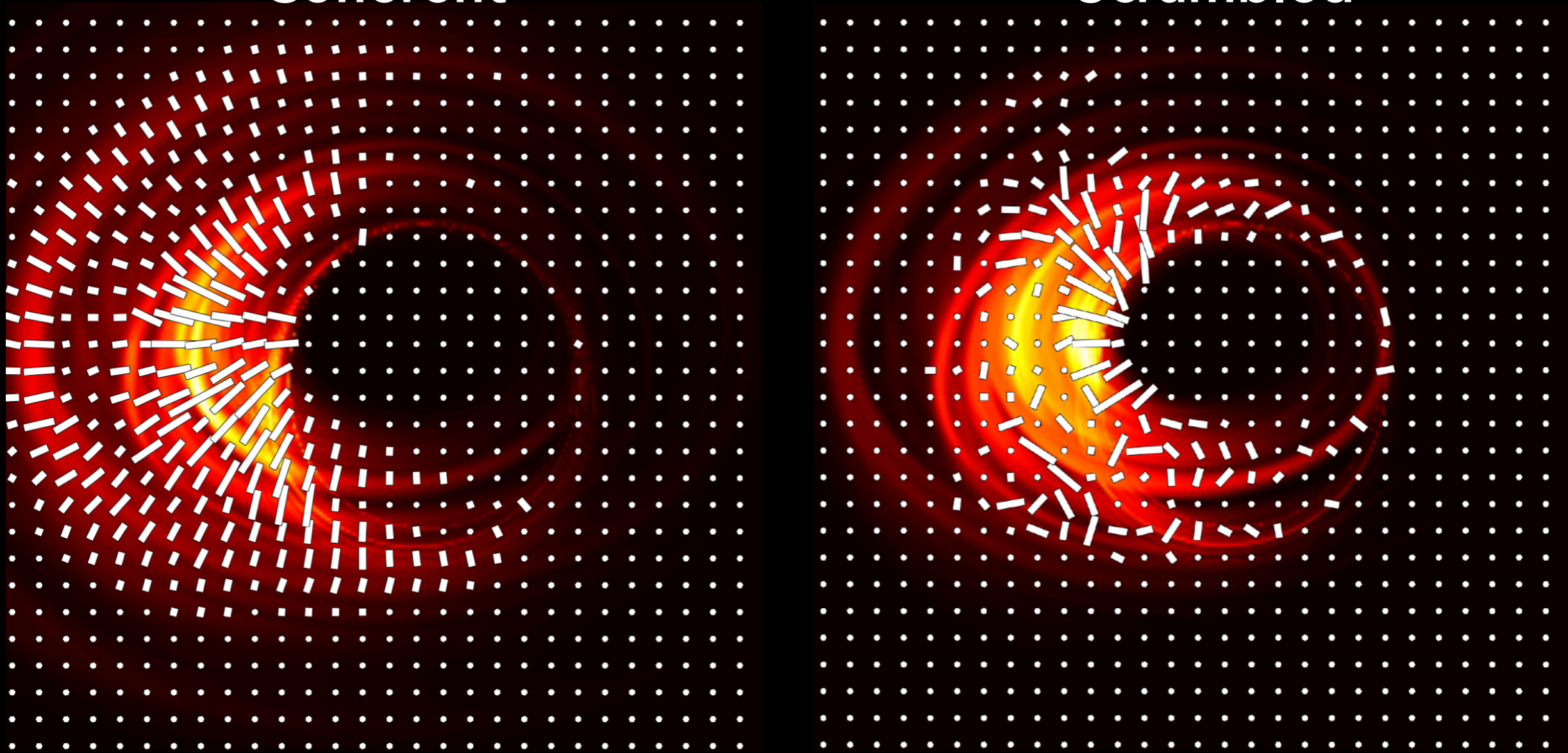
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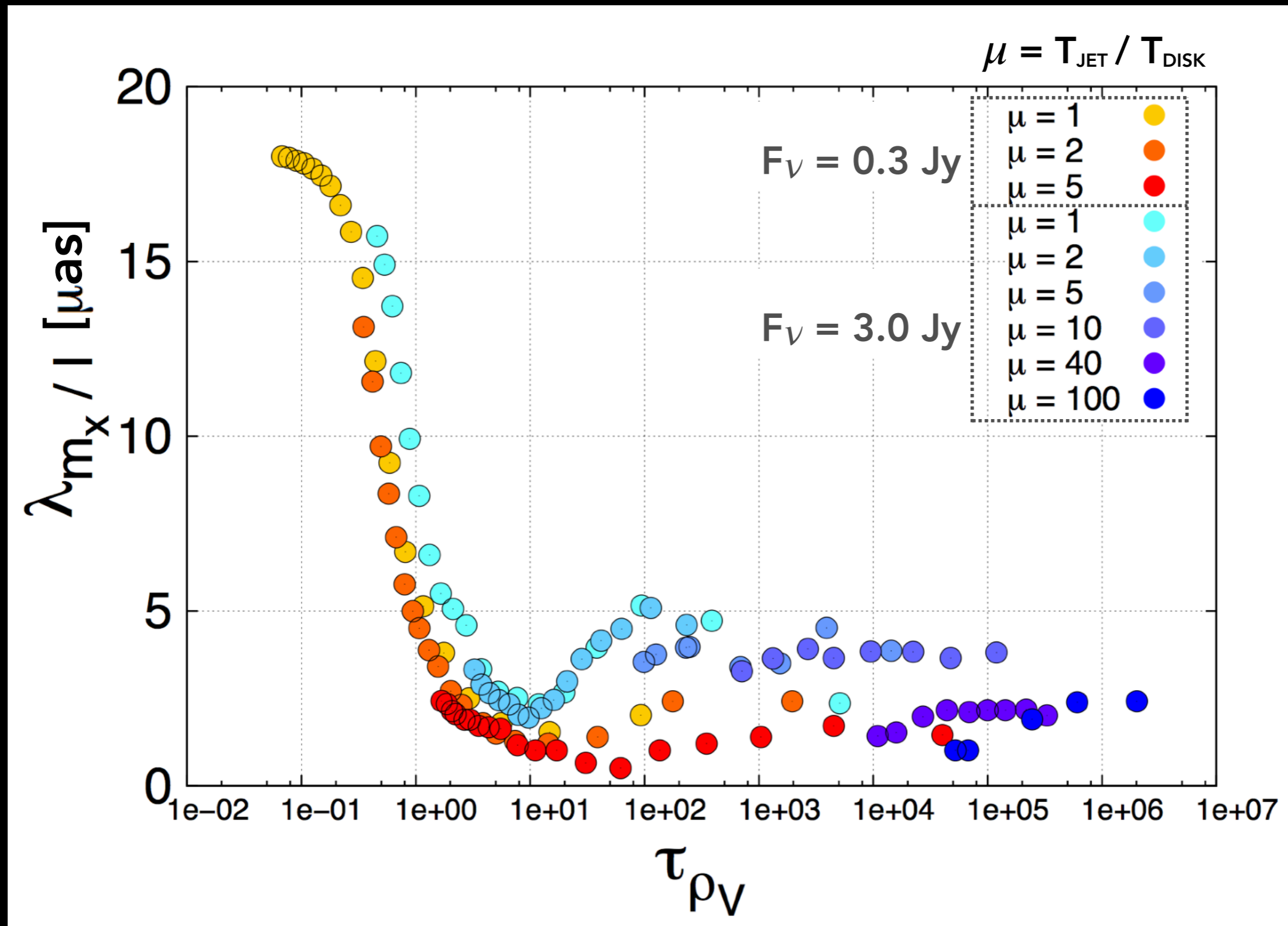
Scrambled



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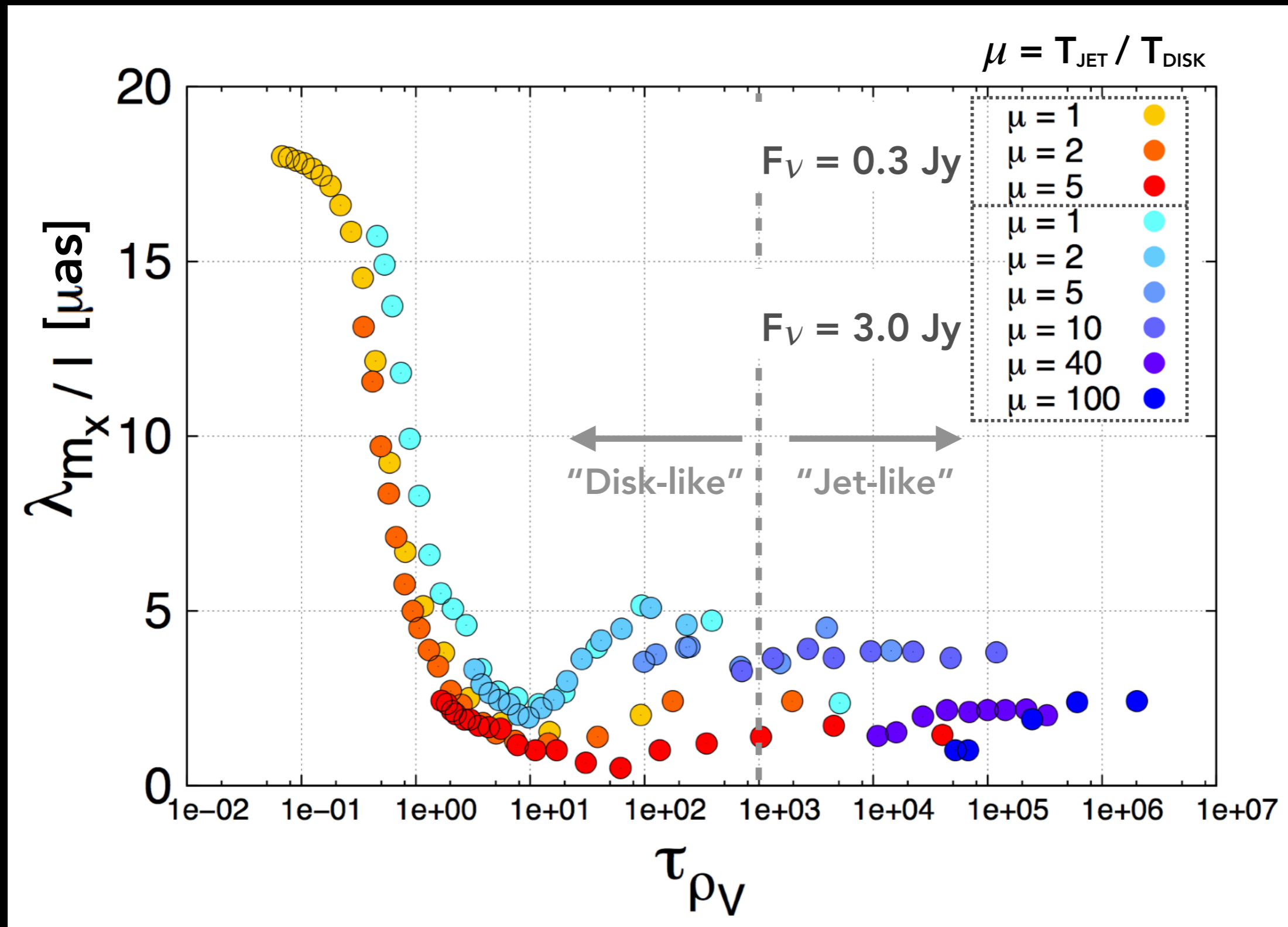
Quantifying the degree of order within the map with a
"**CORRELATION LENGTH**".

THE CORRELATION LENGTH: $\lambda_{m_x/l}$



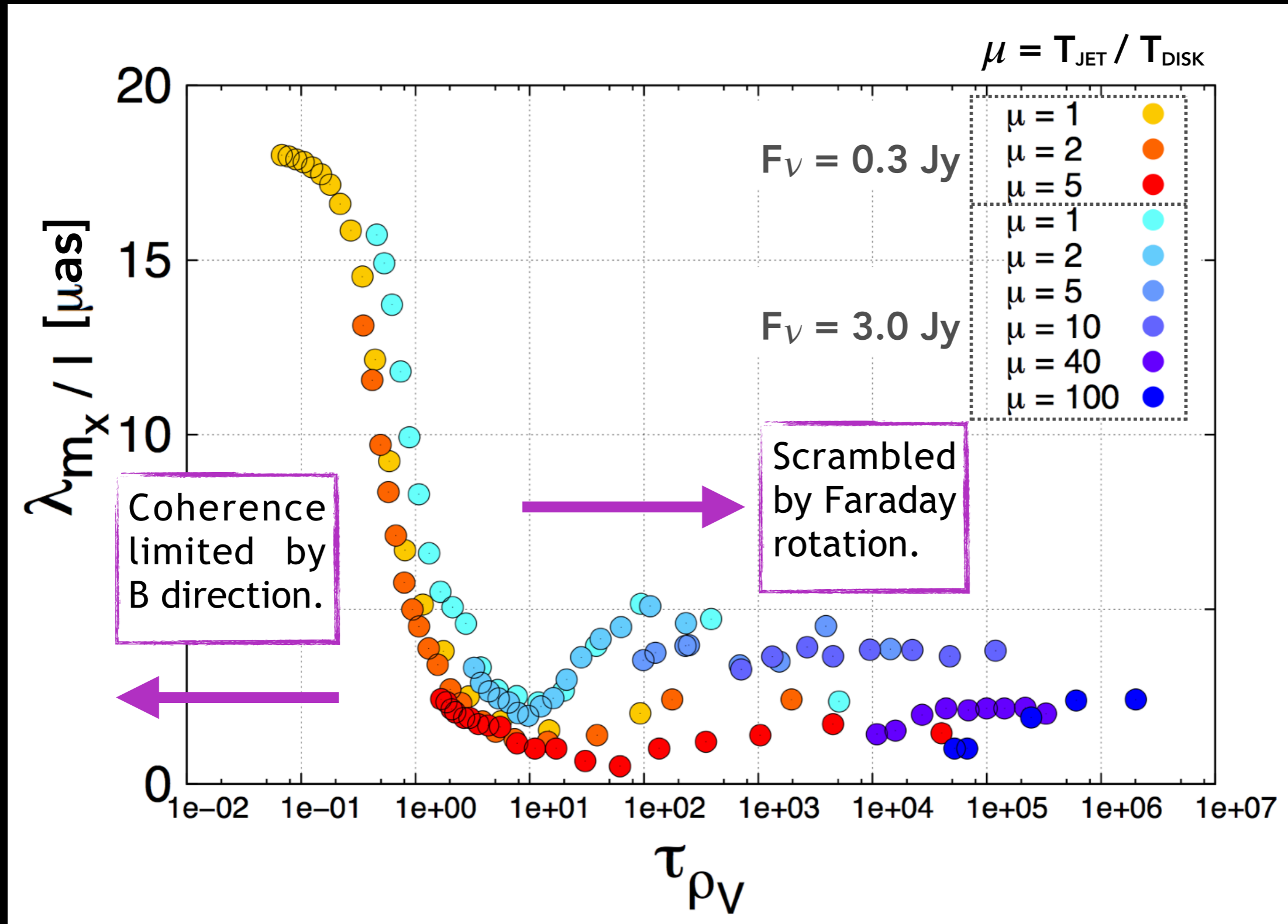
(Jimenez-Rosales in prep.)

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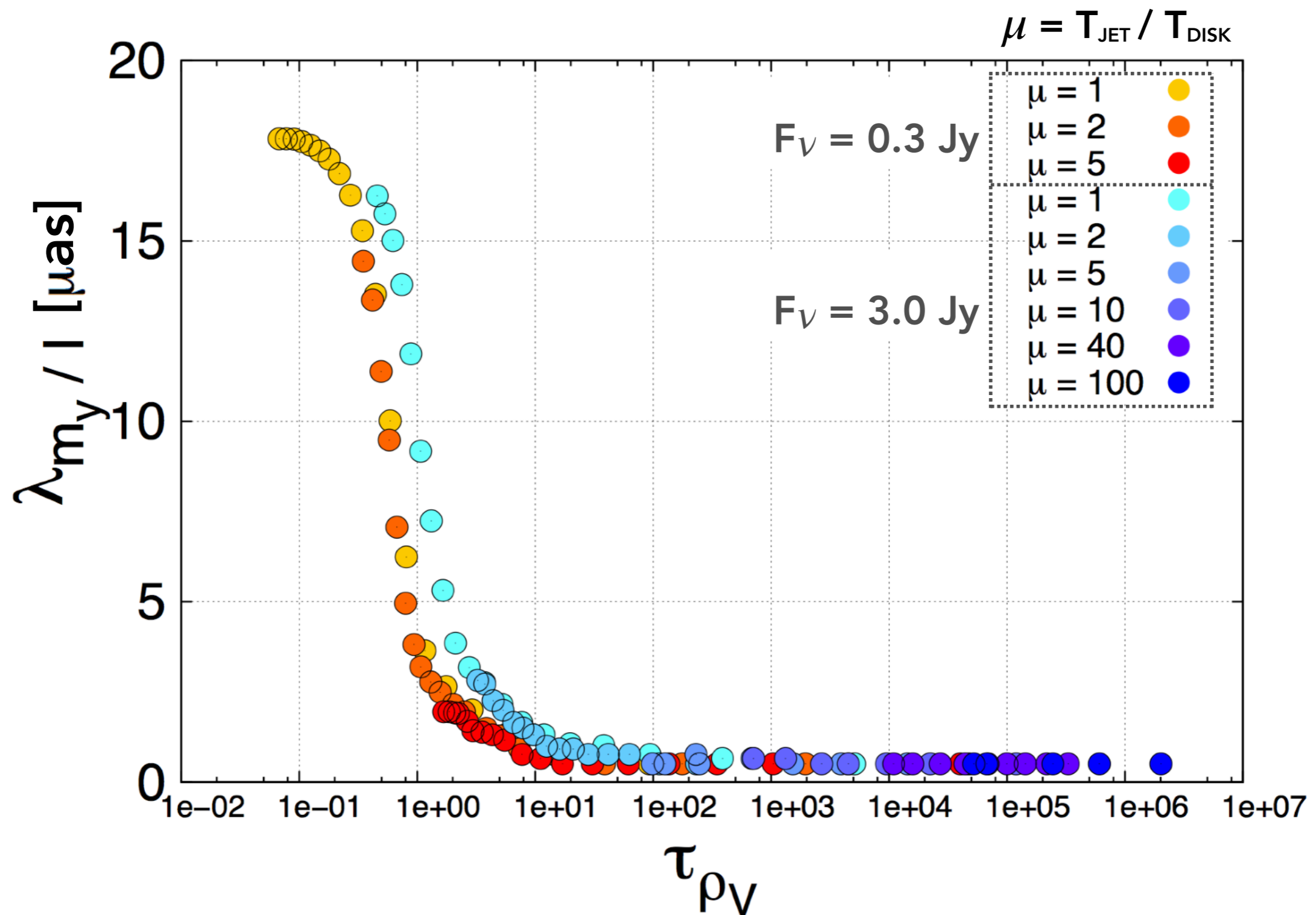
(Jimenez-Rosales in prep.)

THE CORRELATION LENGTH: $\lambda_{m_x/l}$



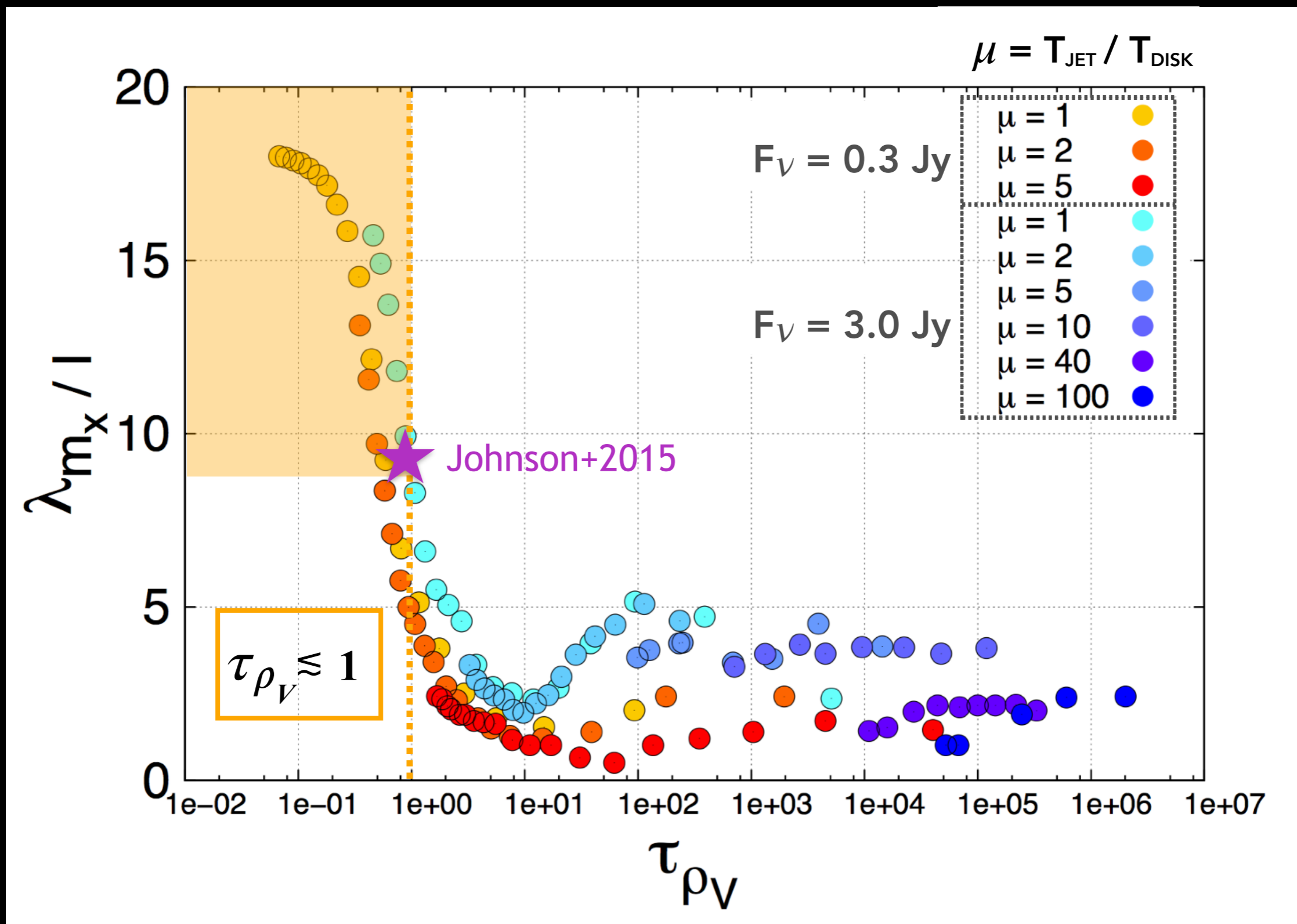
(Jimenez-Rosales in prep.)

THE CORRELATION LENGTH: $\lambda_{m_y/l}$



(Jimenez-Rosales in prep.)

THE CORRELATION LENGTH: as a way of **RESTRICTING** models.



(Jimenez-Rosales in prep.)

CONCLUSIONS.

- ▶ **SGR A*** is important for studying plasma and accretion physics.
- ▶ **POLARISATION** is essential in determining the valid models for Sgr A*.
- ▶ Quantitative analysis of how **FARADAY EFFECTS** depolarise the emitted radiation can be made through the **CORRELATION LENGTH**.
- ▶ So far $\tau_{\rho_V} \lesssim 1$, which could rule out a large parameter space of models where the disk is cold.