Ray-Tracing in 3D Relativistic Magnetohydrodynamic Jet Simulations

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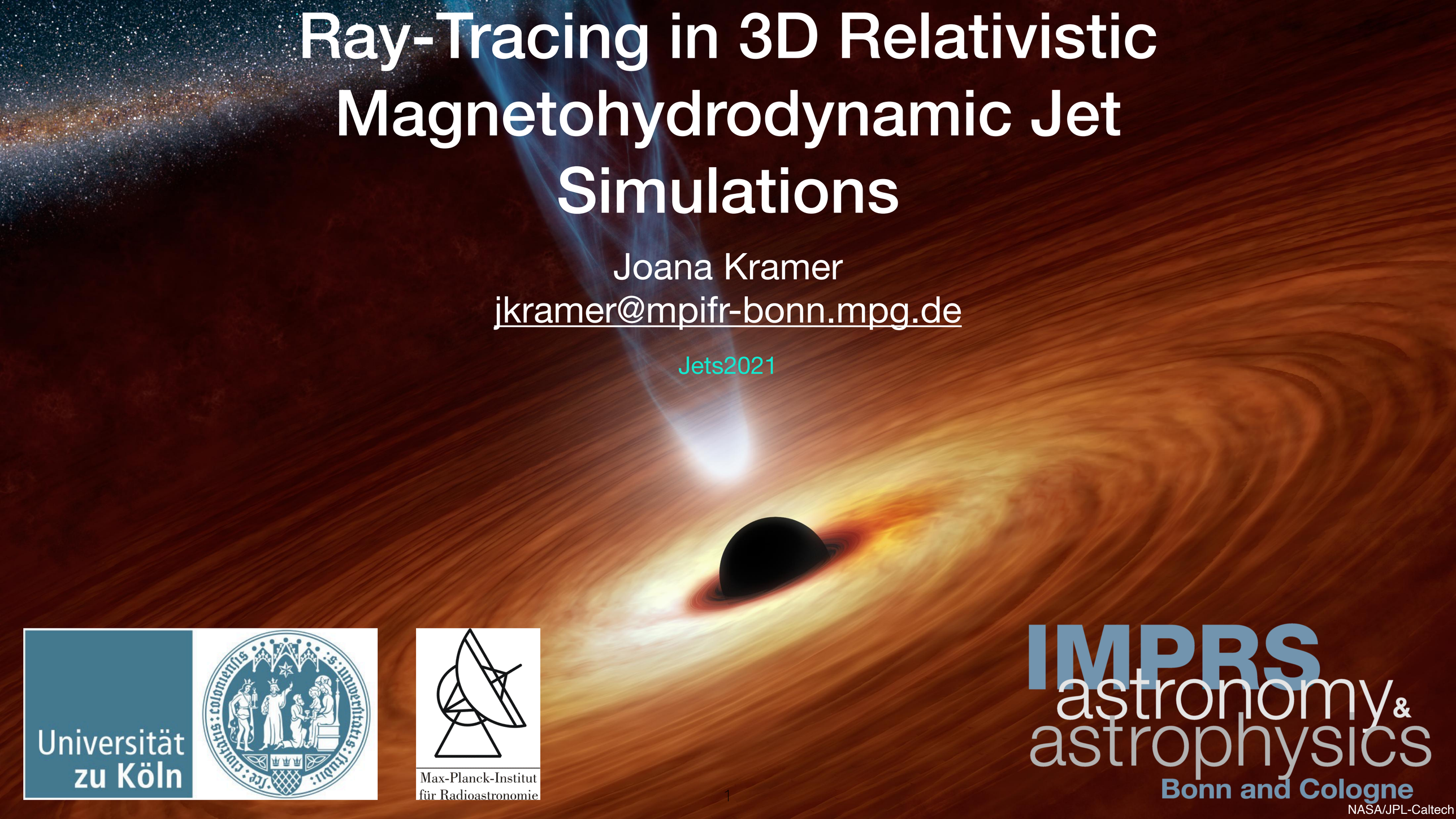

Universität zu Köln

Max-Planck-Institut für Radioastronomie

IMPRS astronomy & astrophysics Bonn and Cologne

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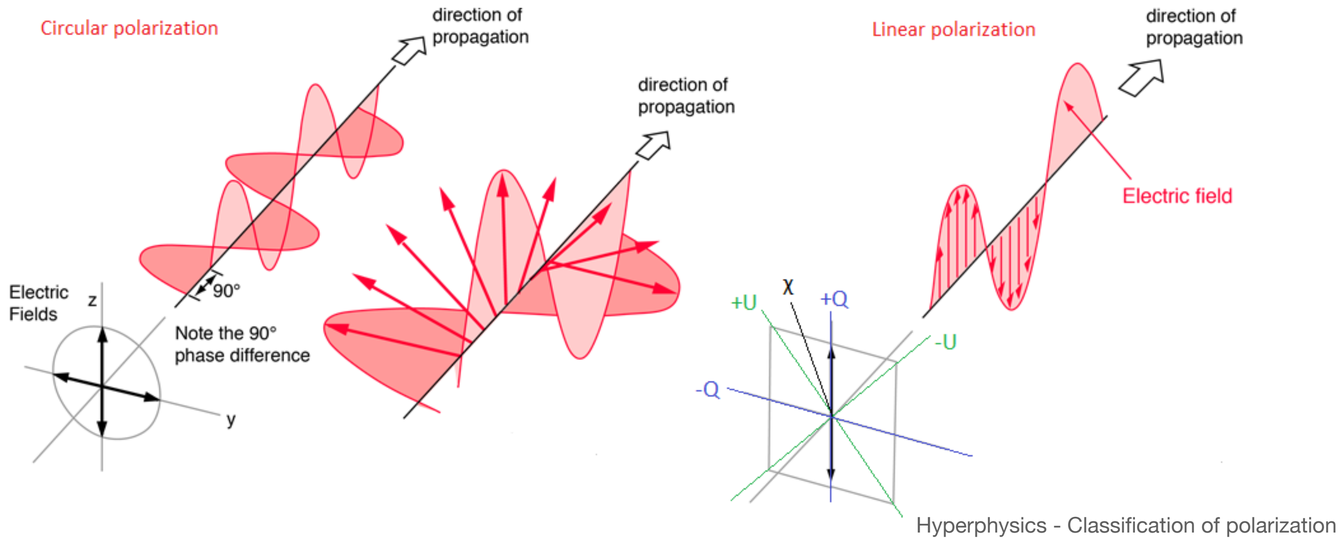
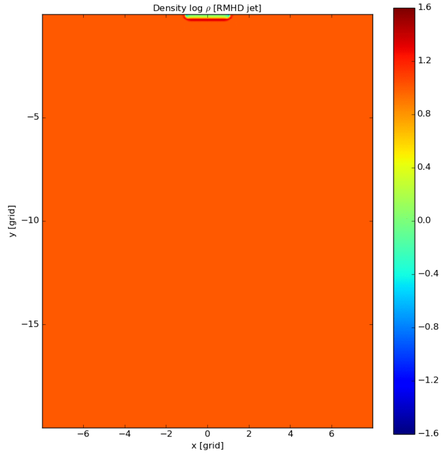
Polarized Emission, *PLUTO*, and *RADMC-3D*



Hyperphysics - Classification of polarization

Stokes

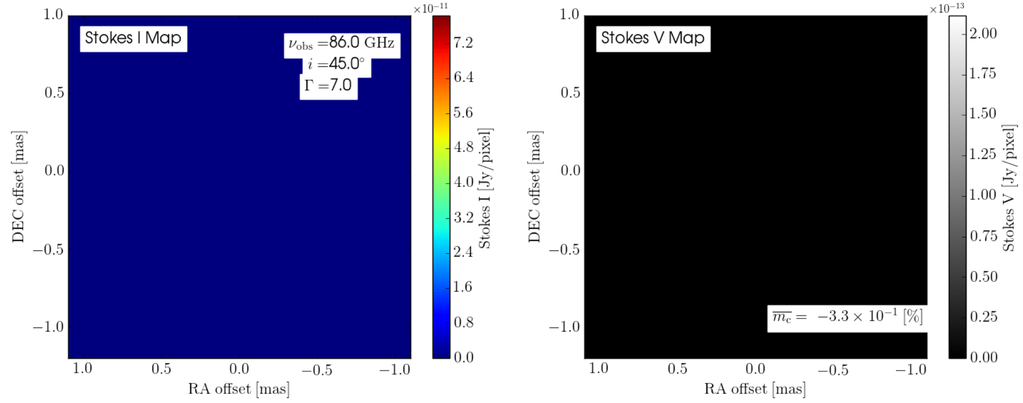
$$I = \epsilon_1^2 + \epsilon_2^2$$
$$Q = \epsilon_1^2 - \epsilon_2^2$$
$$U = 2\epsilon_1\epsilon_2 \cos(\Phi_1 - \Phi_2)$$
$$V = 2\epsilon_1\epsilon_2 \sin(\Phi_1 - \Phi_2)$$



- **For the first time ever:**
  we perform a full Stokes analysis including analyzing the circular polarized emission

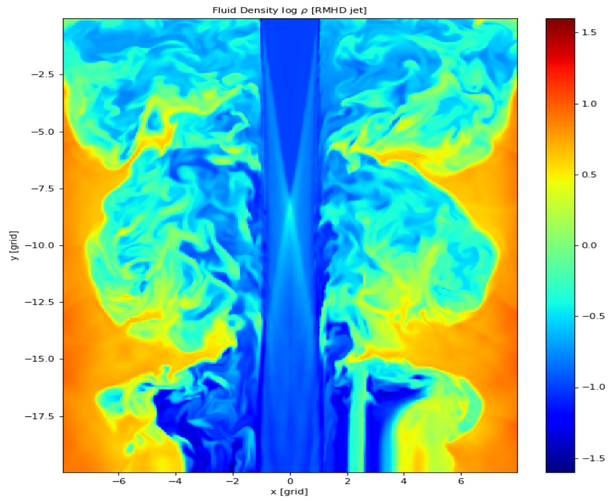
- ***PLUTO*:** solves a time-dependent non-linear system of special relativistic conservation laws (mass, energy momentum) and Maxwell's equations. Mignone et al. 2007, © http://plutocode.ph.unito.it/documentation.html

- ***RADMC-3D:*** solves the full Stokes equations of polarized radiative transfer and will create synthetic maps for each Stokes parameter

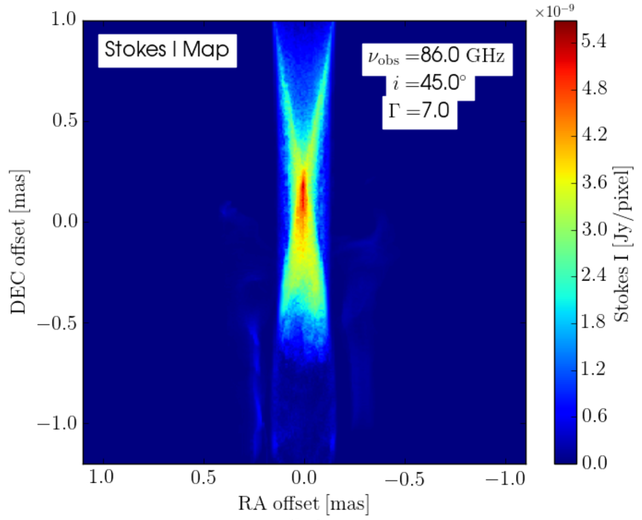


© http://www.ita.uni-heidelberg.de/~dullemond/software/radmc-3d/

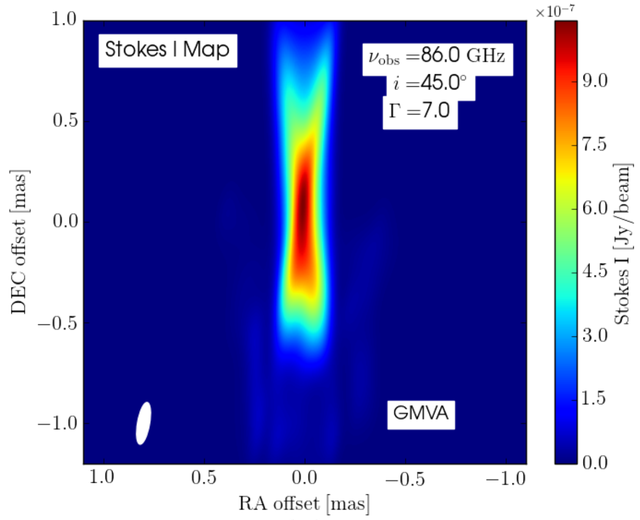
Magnetic Field Morphology and Emission Recipe Study



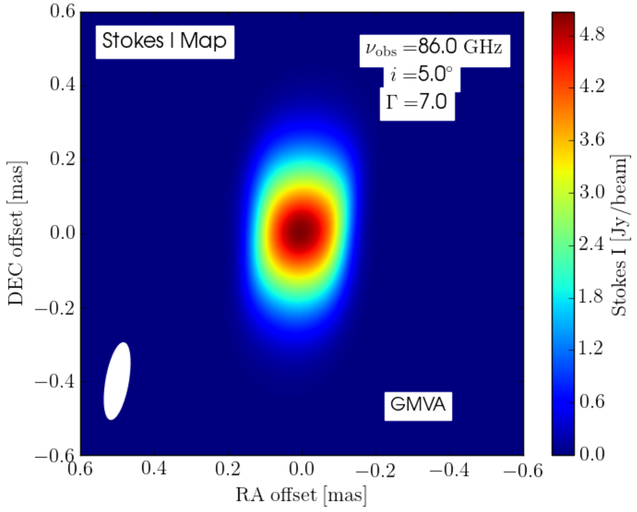
(a)



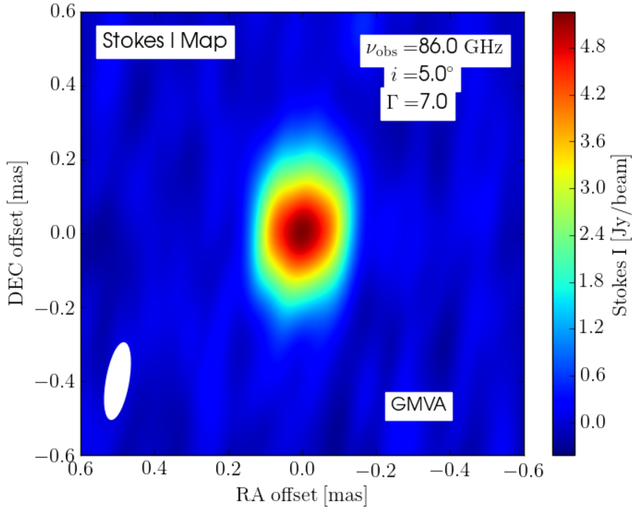
(b)



(c)



(d)

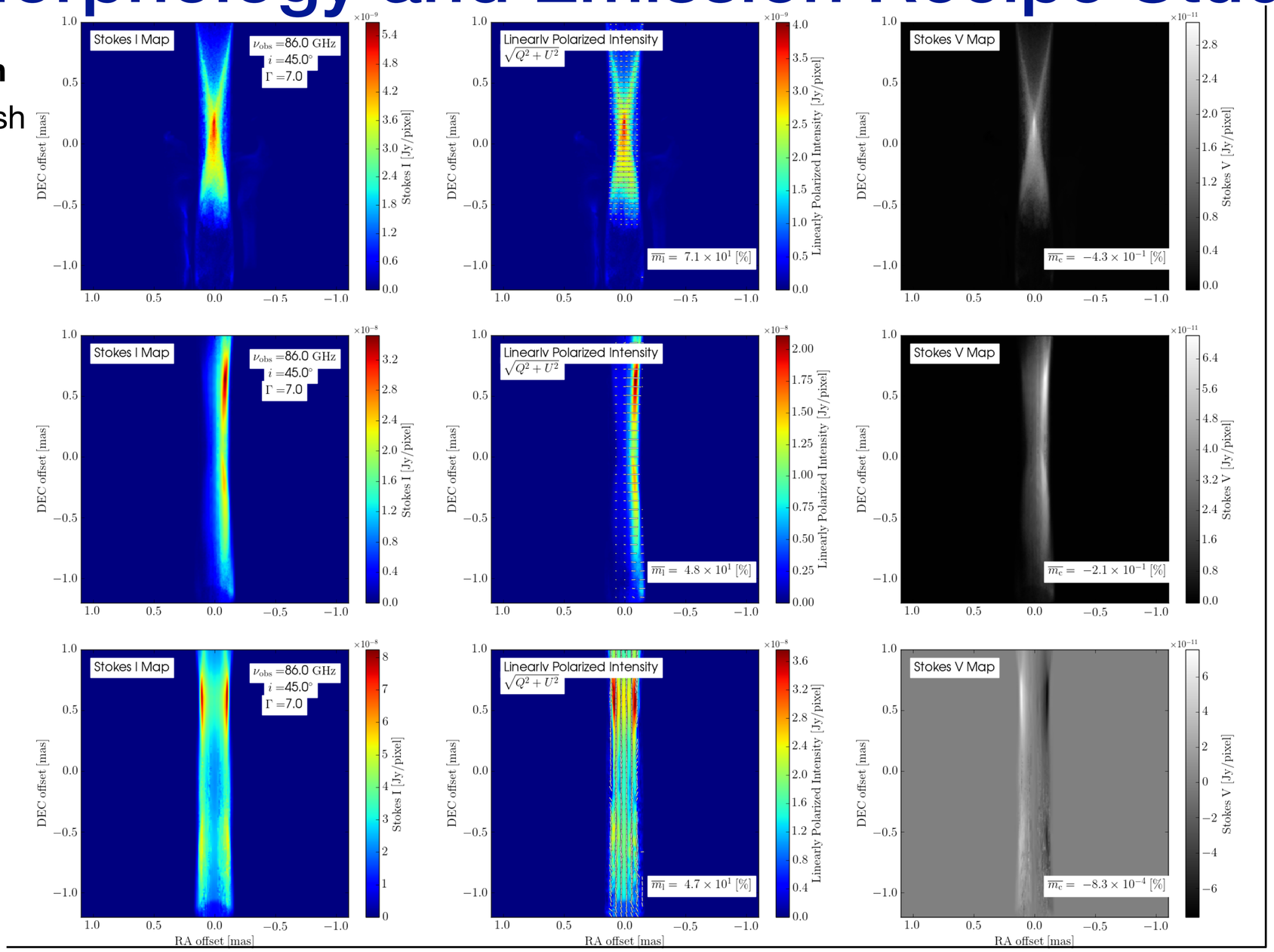


(e)

Kramer & MacDonald in prep.

Magnetic Field Morphology and Emission Recipe Study

- **Resolved linear/circular polarization imaging** has the potential to distinguish between a purely poloidal or purely toroidal magnetic field configuration within standing/recollimation shocks.

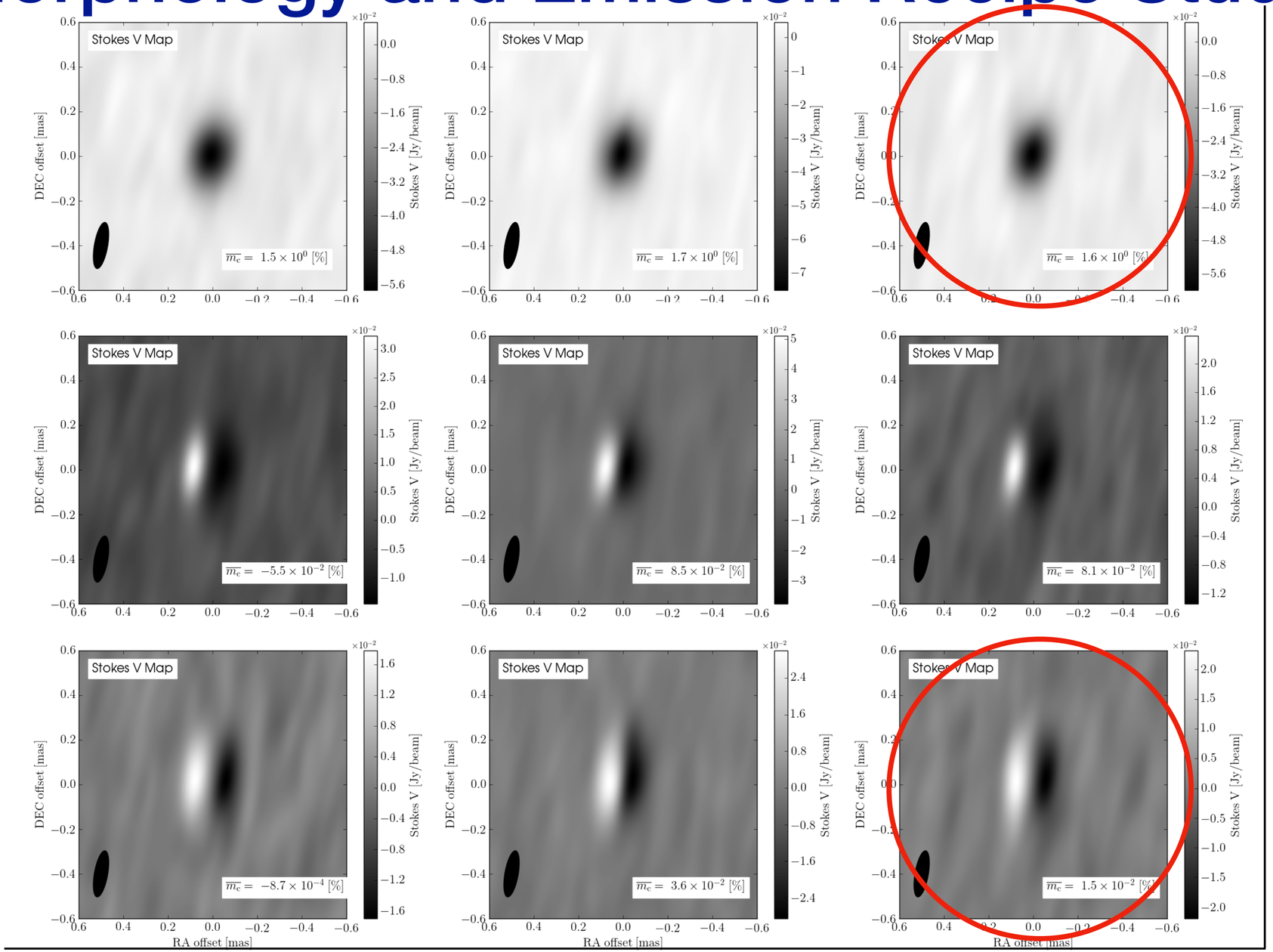


Kramer & MacDonald in prep.

Magnetic Field Morphology and Emission Recipe Study

- **Poloidal:** highlights the inner structure of the jet (near the recollimation shock)

- **Toroidal:** results in jet **edge-brighting**



$n_e(\gamma) \propto \rho$ $n_e(\gamma) \propto p$ $n_e(\gamma) \propto B^2$

Kramer & MacDonald in prep.