Modelling the accretion-ejection flow around the supermassive black hole at the centre of the Milky Way

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Context & Motivation

- Event Horizon Telescope Collaboration Images of M87 and of Sgr A*
- Improvement in numerical modelization of accretion-ejection flow of Sgr A*
- Bigger interest in compact objects' environment and multi-messengers
- Updates in simulator codes: **GYOTO**

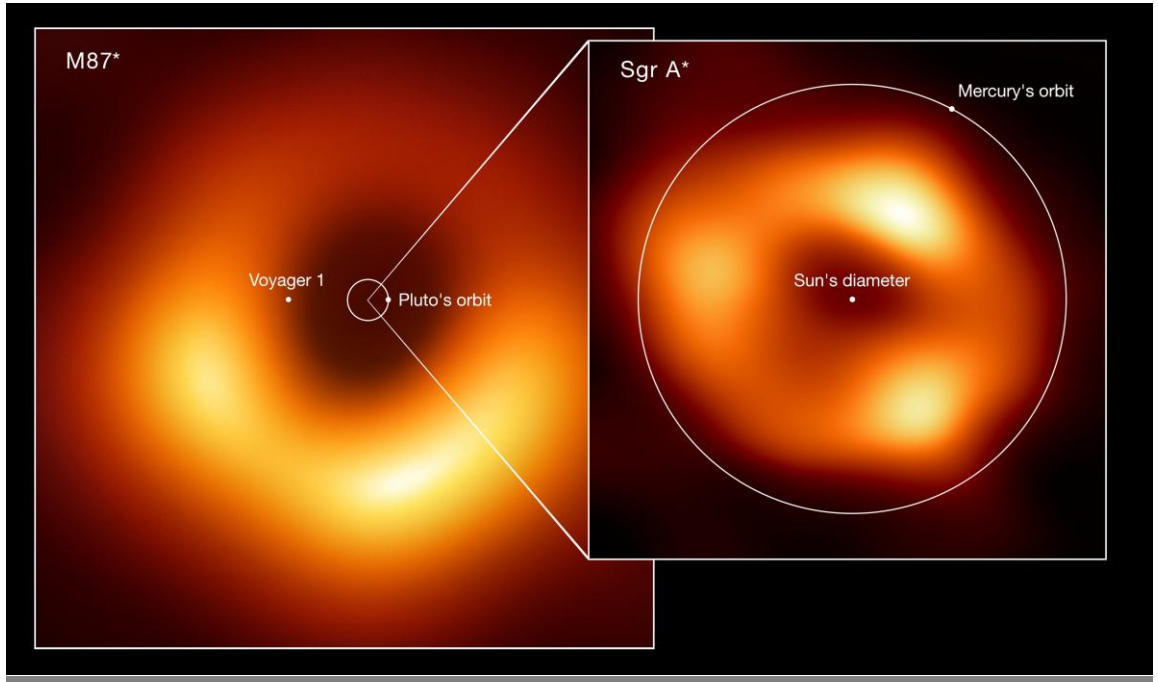


Fig1. Comparison of the sizes of two black holes: M87* and Sagittarius A*. Image made by the EHT collaboration

Objectives

- Create an analytical model
- Reproduce the EHT images of Sgr A*
- Accurately fitting the spectra
- Recreate the observed polarization

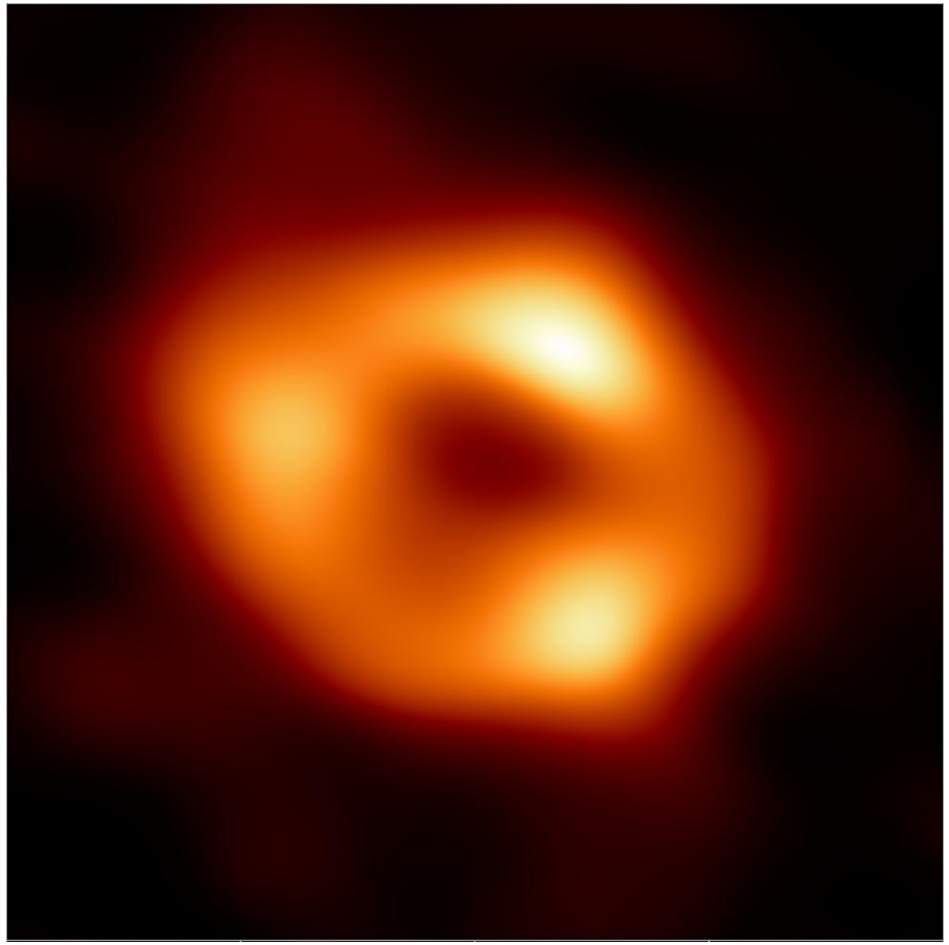


Fig2. Averaged image of Sagittarius A* showing a ring-like structure. Image made by the EHT Collaboration.

Work Done

- Gather results on accretion-ejection numerical simulations
- Explore GYOTO's capabilities as a simulator
- Study of the new parabolic jet model

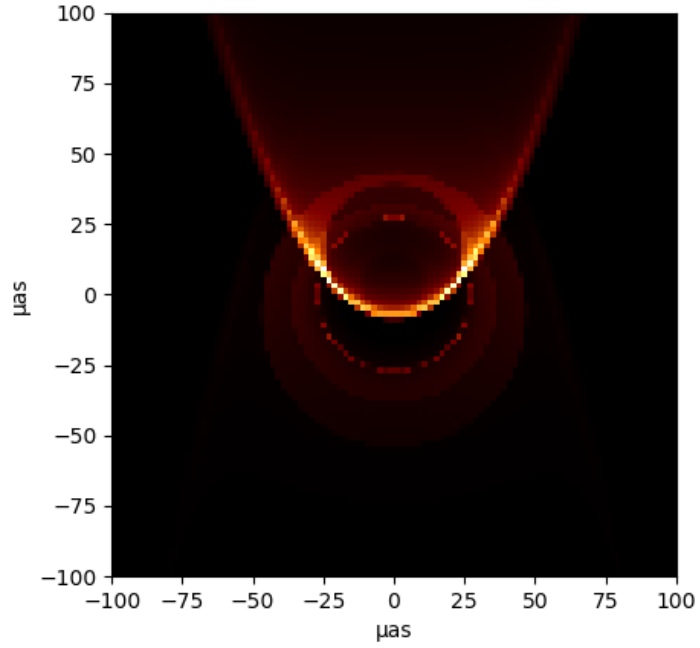


Fig3. Simulated image of a black hole similar to Sagittarius A* using **GYOTO**.

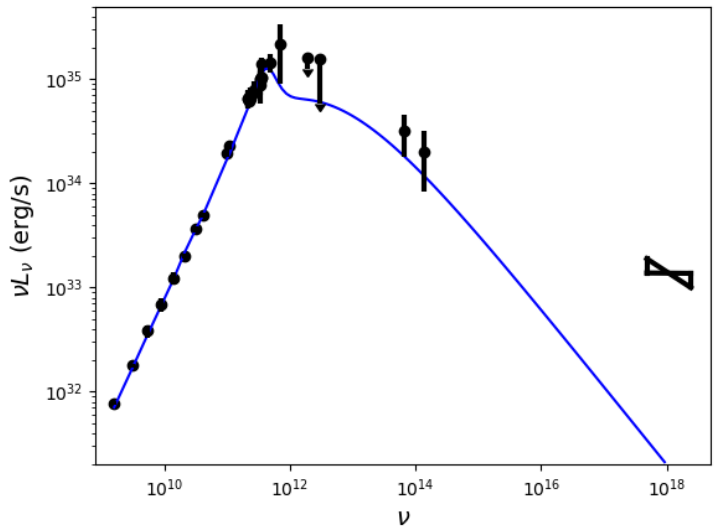
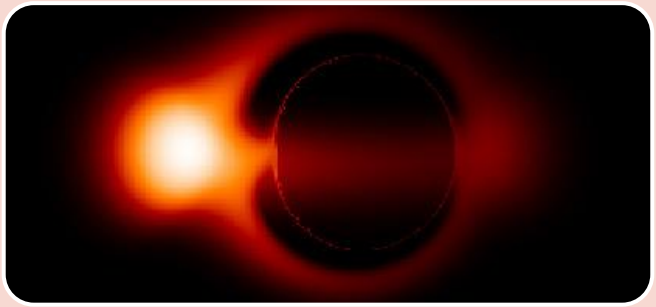


Fig4. Plot of observed data points and simulated spectra line for the torus jet model of *Vincent et al 2019*. (Vincent, F. H. et al. "Multi-wavelength torus–jet model for Sagittarius A*".)

Thank you for your attention

Future Work

Improve GYOTO's parabolic jet model to have more magnetic configuration



Add a thick disk model

Comparison with data (*EHT* image, spectra and polarizarion)

Plotting of the Null Geodesics

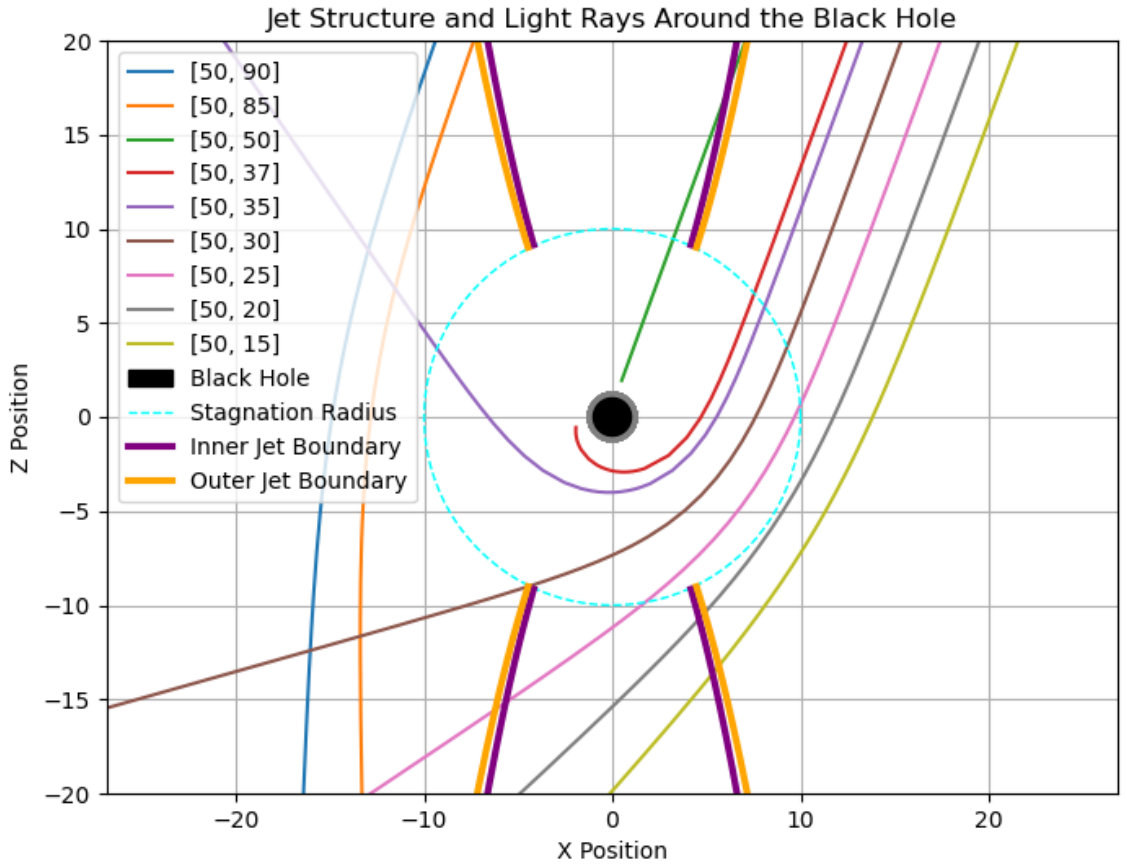


Fig5. Representation of the black hole and its jets. Null geodesics were plotted within the black hole's environment.

Plotting of the Null Geodesics

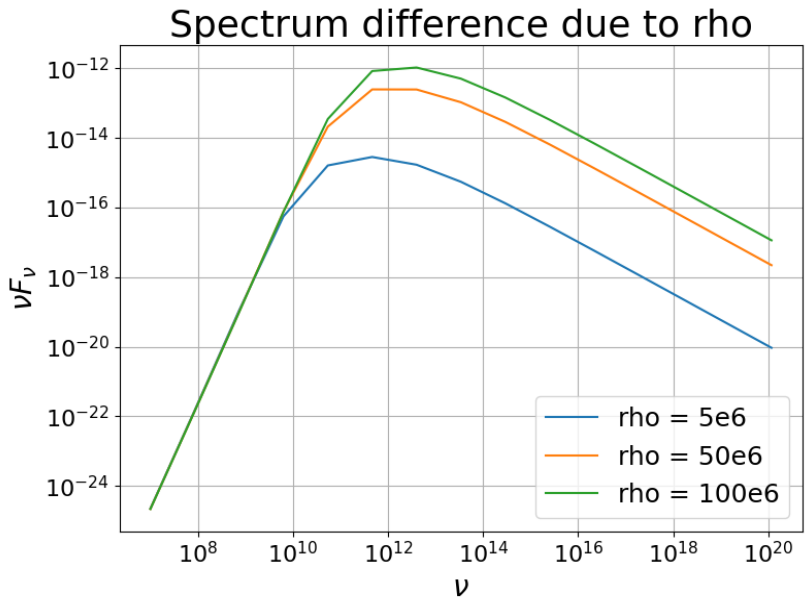


Fig6. Impact of plasma density in simulated observed spectrum.

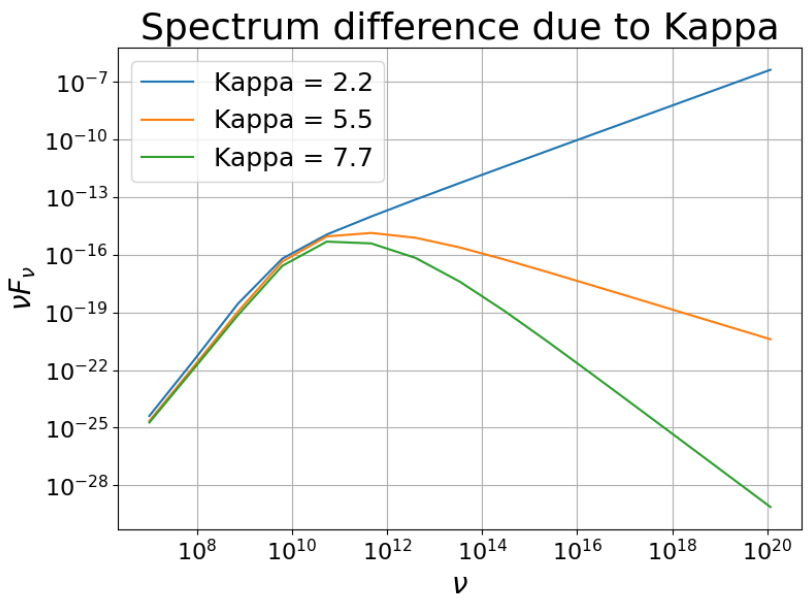


Fig7. Impact of κ-distribution index in simulated observed spectrum.

Magnetic Configuration

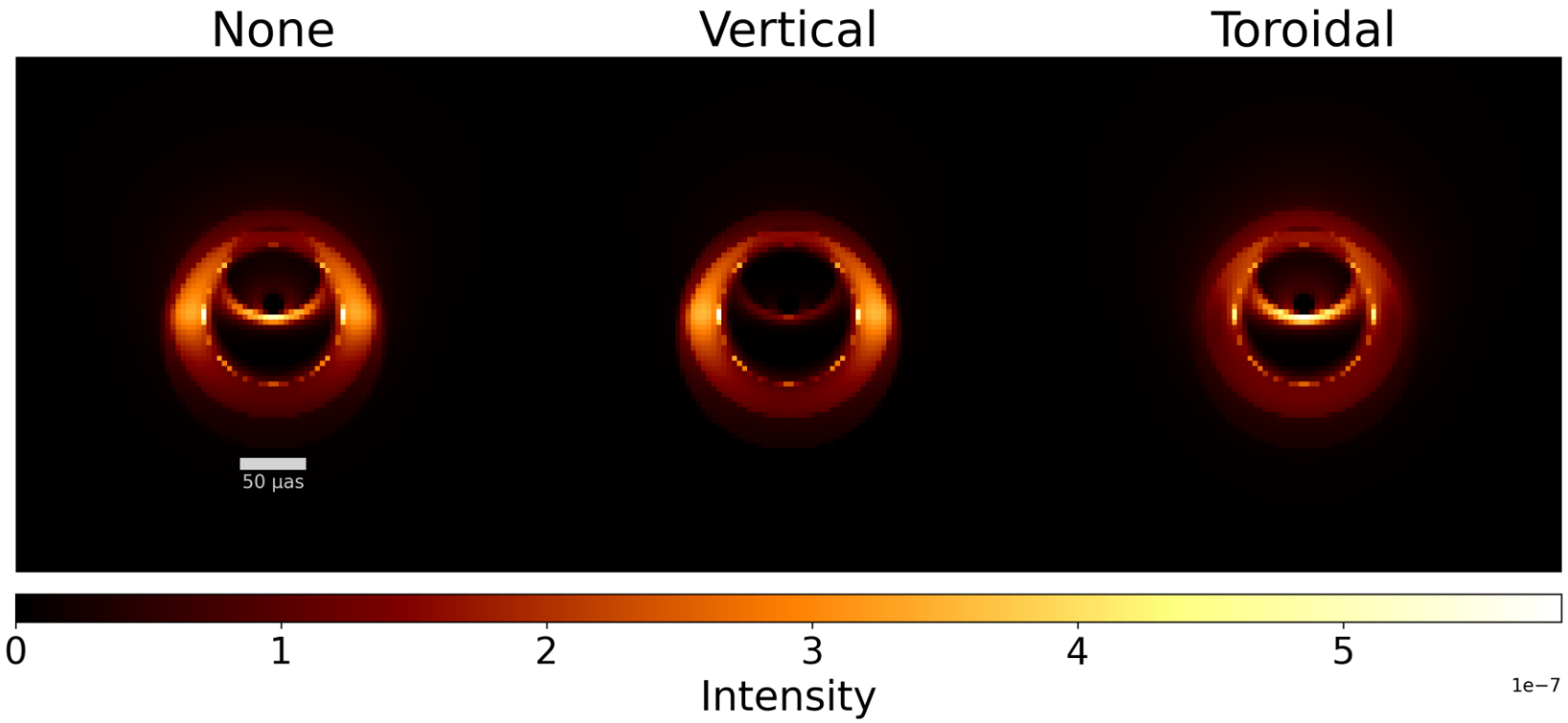


Fig8. Black hole synthetic images generated with different magnetic configurations for a conical jet model.

Light Polarization

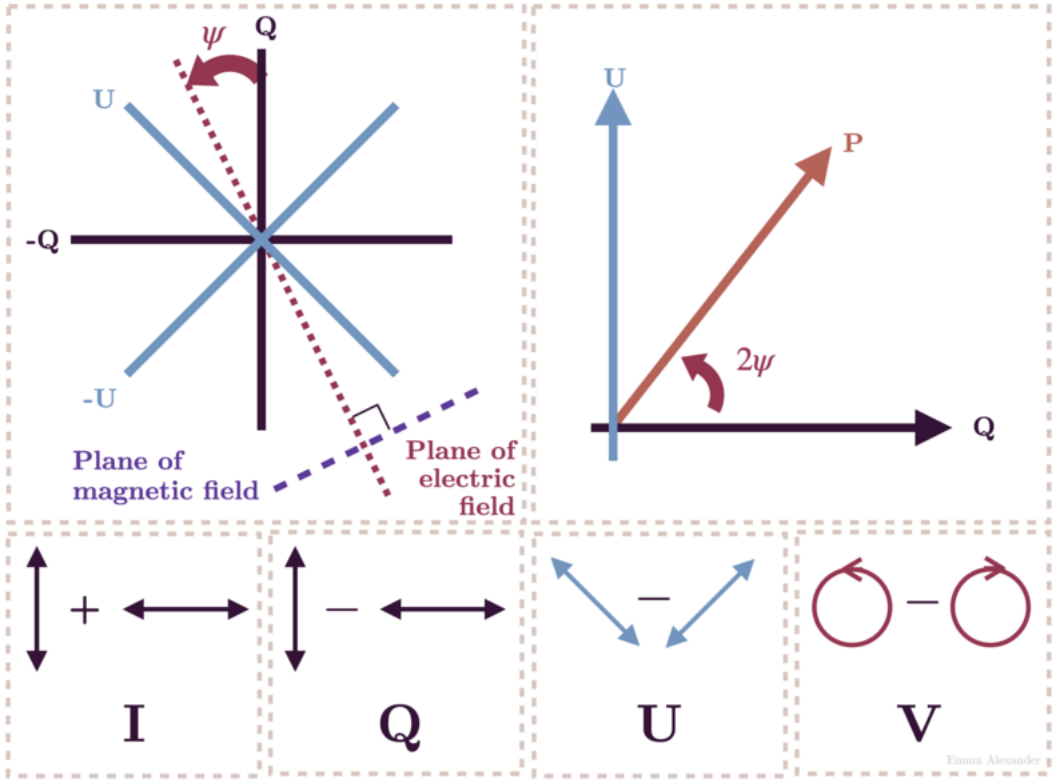


Fig9. Representation of the different Stokes Parameters. Image found in Emma Alexander's page: https://emmaalexander.github.io/resources.html . Full credits to the author.

Light Polarization

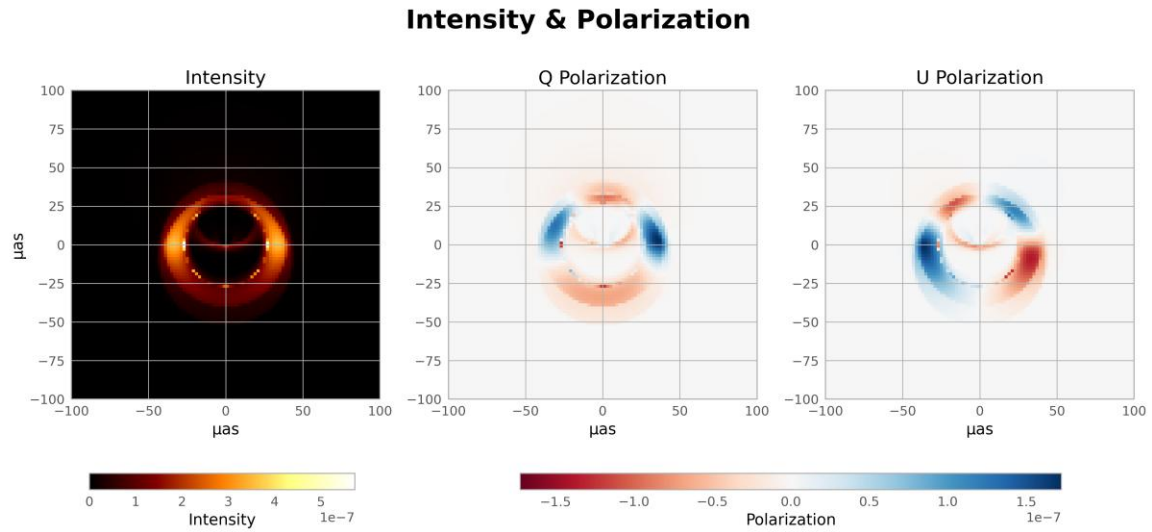


Fig10. Intensity image generated with **Vertical** magnetic configuration and its corresponding Q and U stokes parameters.

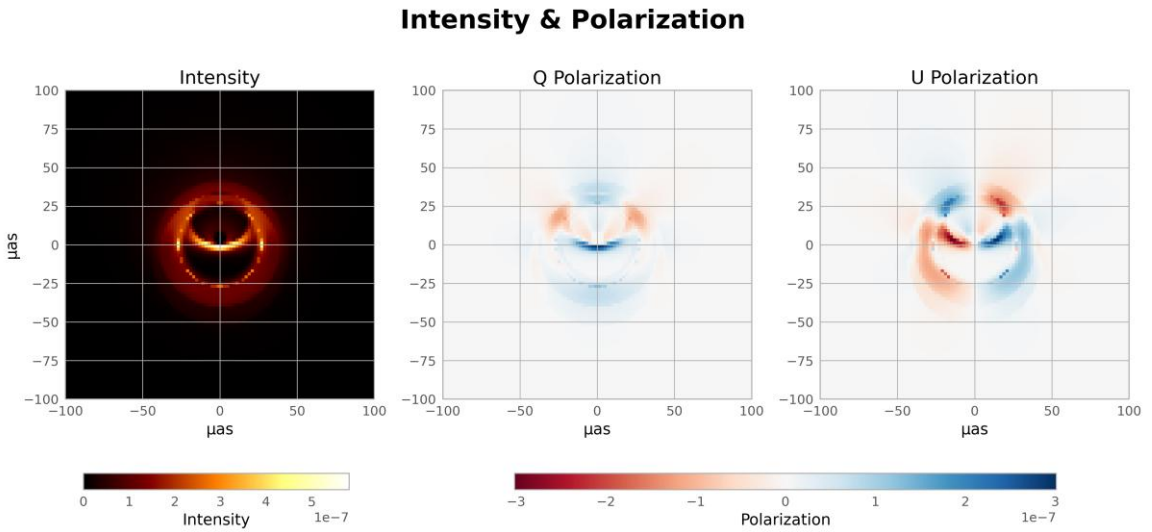


Fig11. Intensity image generated with **Toroidal** magnetic configuration and its corresponding Q and U stokes parameters.