

A General Relativistic Magnetohydrodynamic Model for the Emission Structure of the M87 Jet

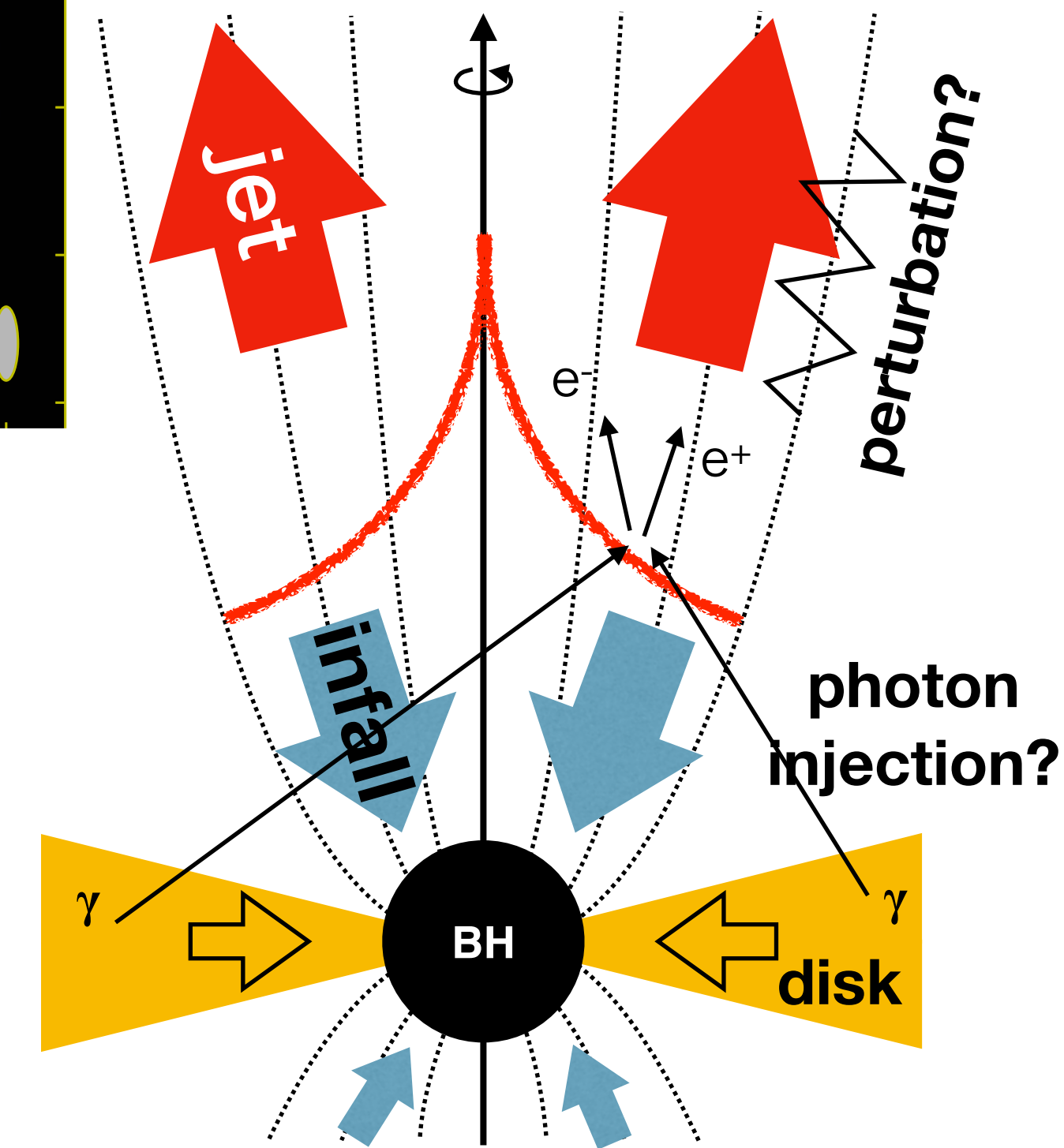
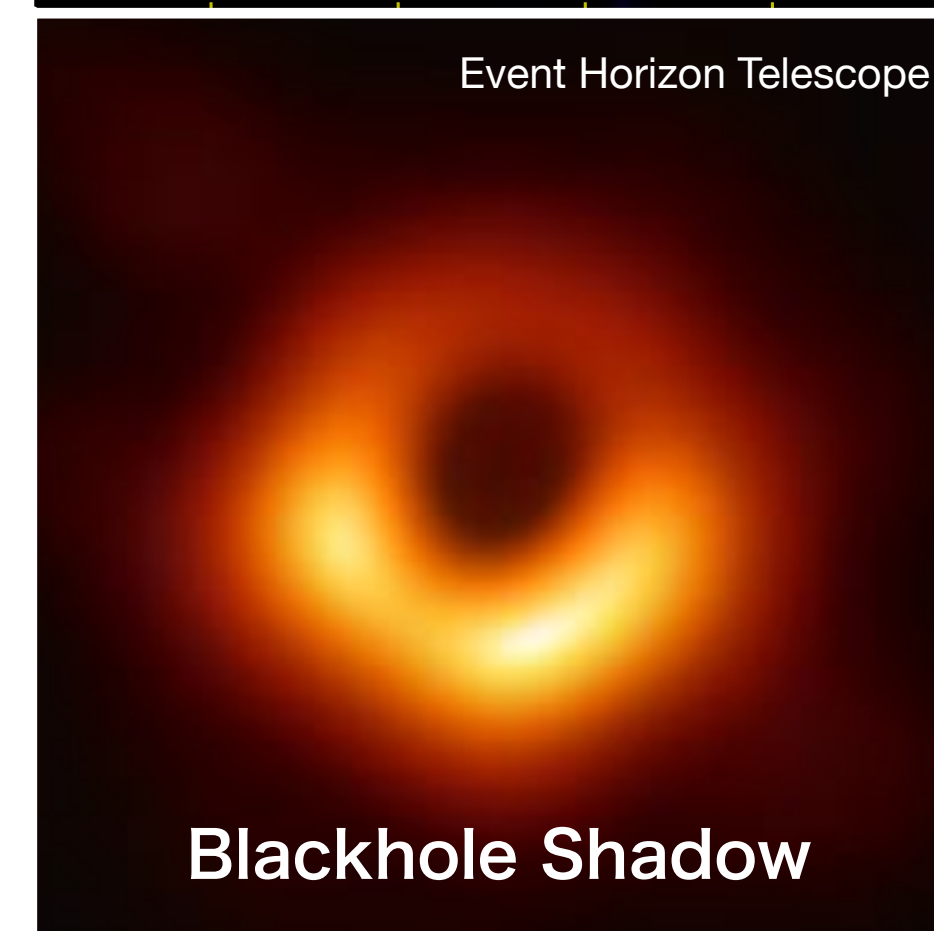
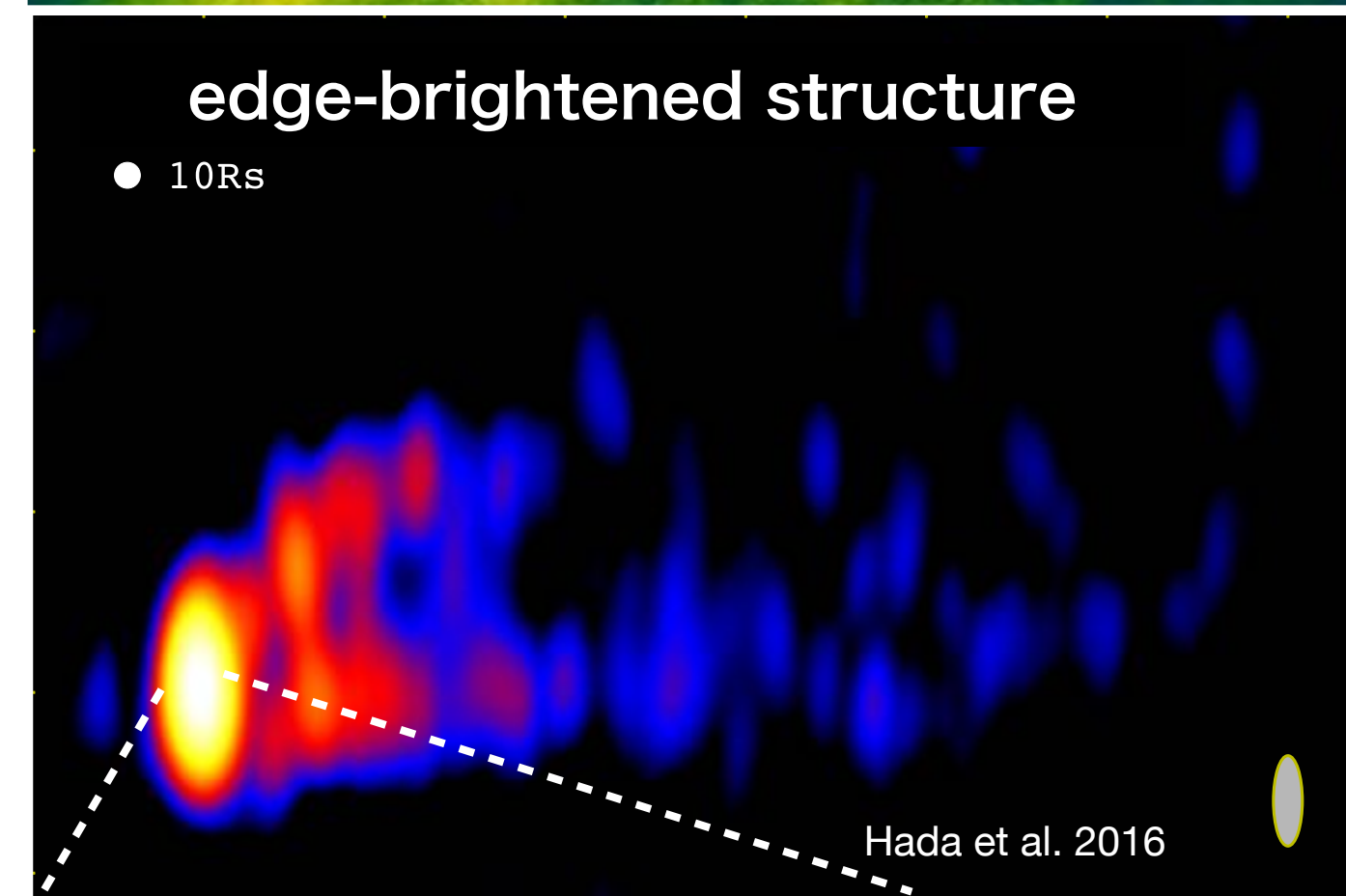
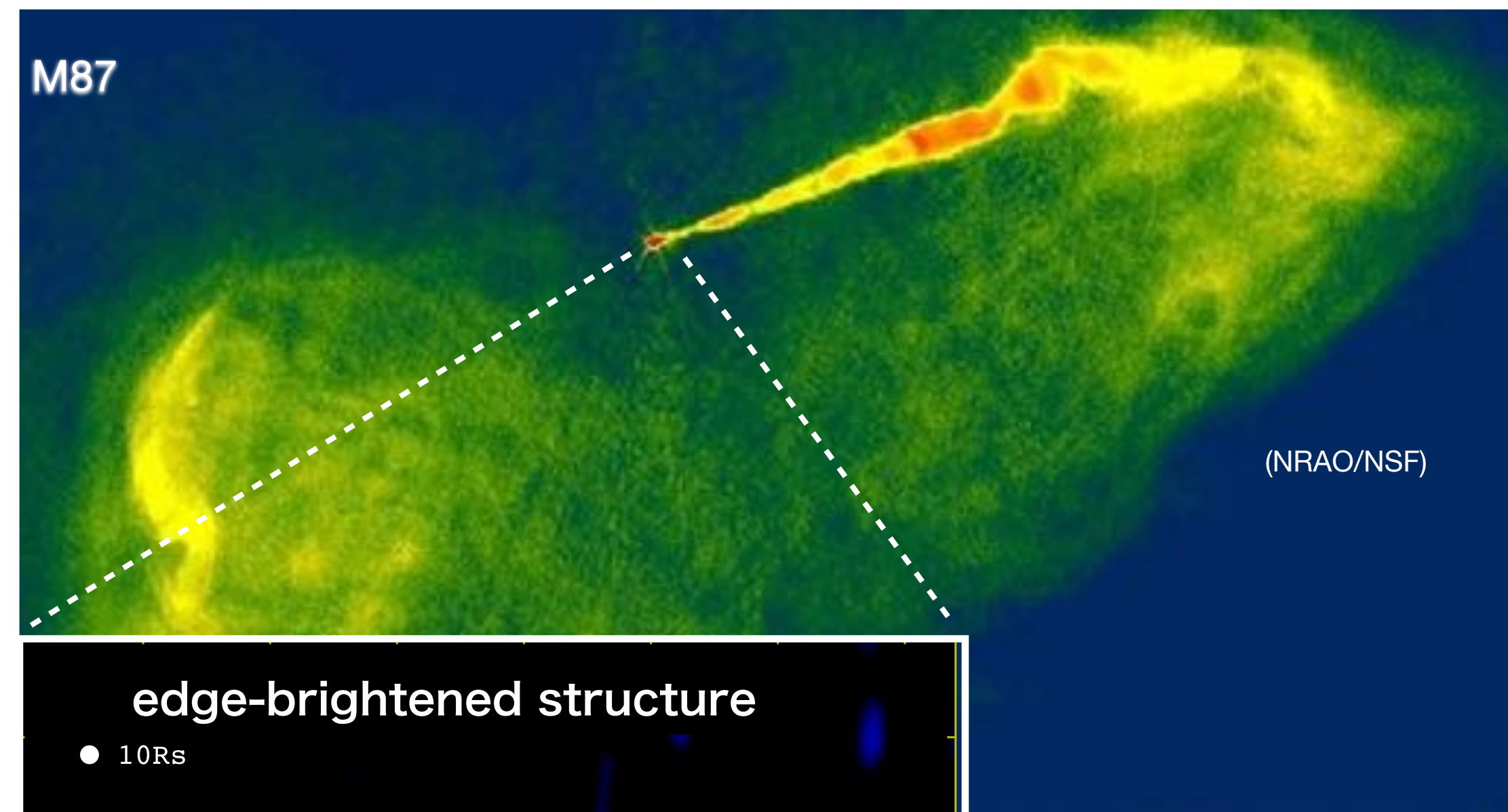
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20/05/29, GPPU Progress Report



AGN jets

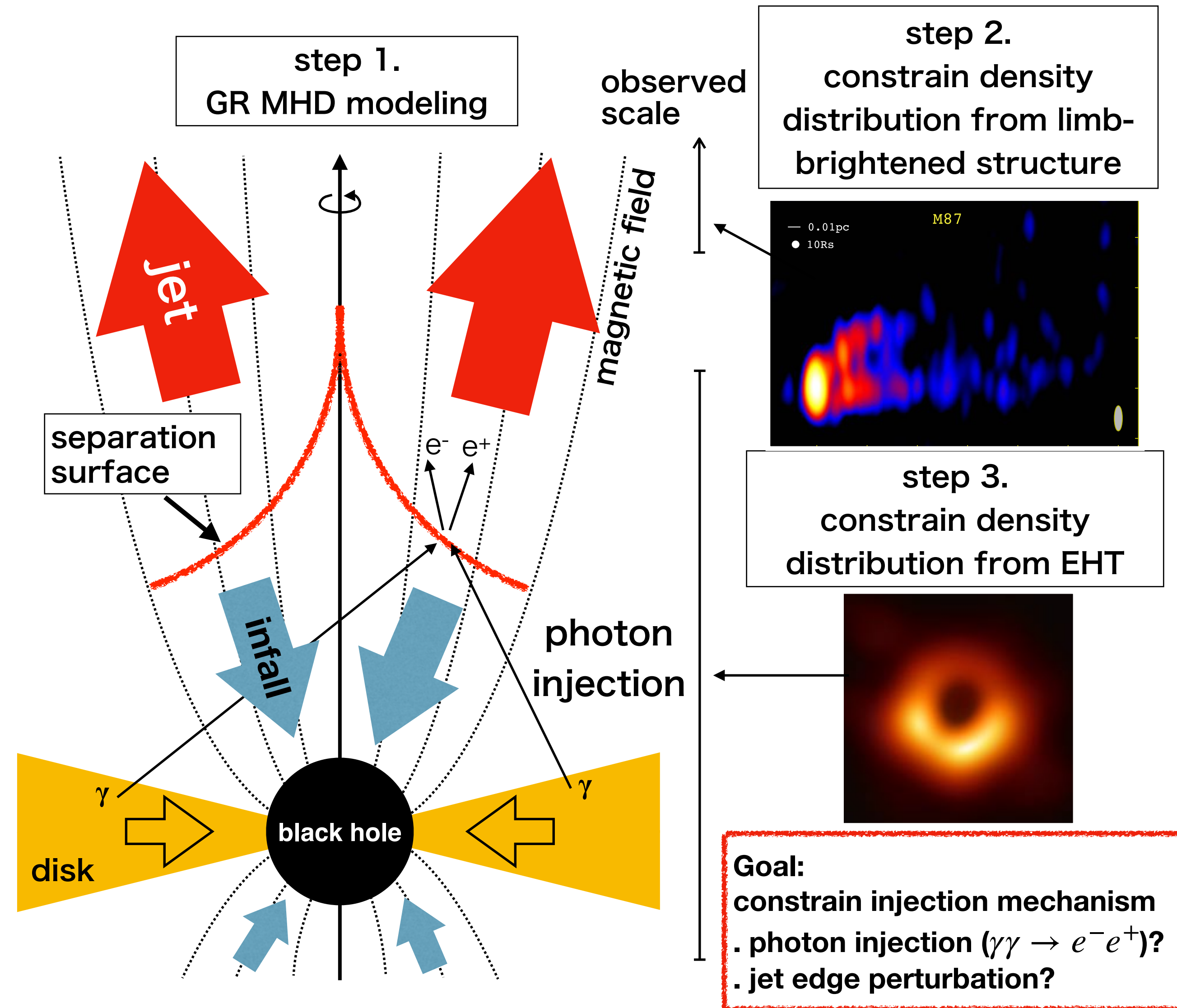
- Active Galactic Nucleus (AGN) Jets:
 - relativistic collimated outflow from a center of galaxies
 - driven by black hole electromagnetically
 - can be a source of high energy **cosmic rays** or **astrophysical neutrinos**
 - **The Event Horizon Telescope have observed just around the black hole, and will observe jet launching region soon!**
- **Where the jetted matter come from?**
(Of course, not from the black hole!!)
- **How the jetted matter injected?**
 - . photon injection ($\gamma\gamma \rightarrow e^-e^+$)?
 - . jet edge perturbation?



Research Plan

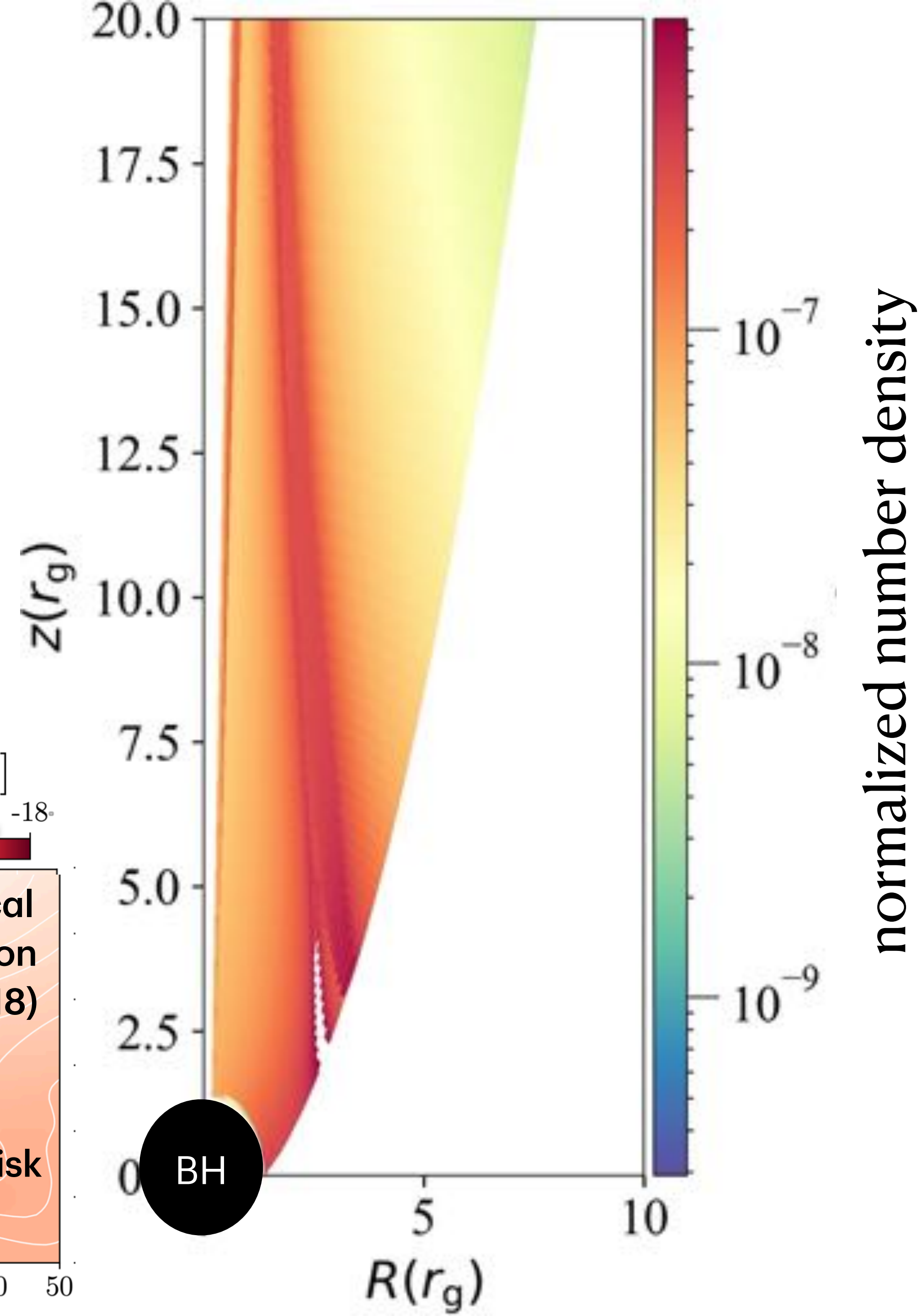
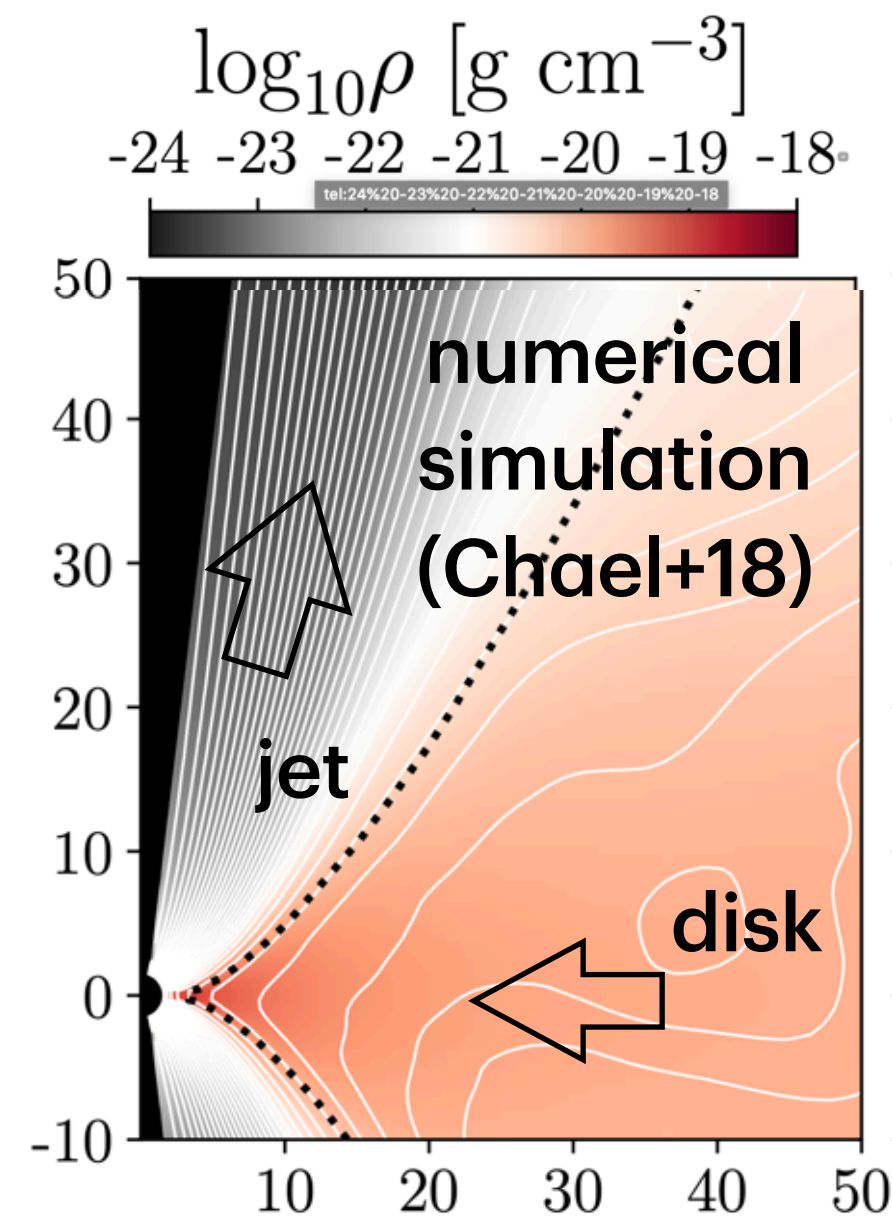
- M87: characteristic emission structure on various scale
- From the emission structures, constrain the density distribution in jet and injection mechanism
- **step 1 (jet modeling):** make approximated analytical solution ← **DONE**
- **step 2 (explain emission structure):** estimate density structure and check consistency with injection physics ← **THIS YEAR**
- **step 3 (predict the future EHT jet image):** apply for the very vicinity of blackhole

**focusing on observed jet structure,
constrain density distribution in the jet
→ predict EHT “jet” image**



Results

- solve the basic equations of steady axisymmetric general relativistic ideal MHD (no resistivity, no gas pressure)
- assume poloidal magnetic field which is consistent with simulation's results.
- **In simulations, the very low density is difficult to treat without artificial mass-injection.**
- **We obtain the density distribution inside jet semi-analytically.**



Future Plan

- seminar point
 - GSP: 21
 - GSAP: 6
- class
 - 宇宙創成物理学特殊講義I (履修登録済)
 - 宇宙創成物理学特殊講義II (履修登録済)
 - 宇宙創成物理学特別国際研修 (履修登録済)
 - 博士研修(天文学特別研究) (履修登録済)
- staying overseas
 - 18 days so far
 - 2 conferences (10 days) this year
- collaboration
 - Hun-Yi Pu (Waterloo Univ., Canada)
 - This work
 - 17 received emails since Feb. 2019
 - planning to visit
 - Jose Gomez (Spain)
 - another work
 - 7 received emails since Sep. 2019