

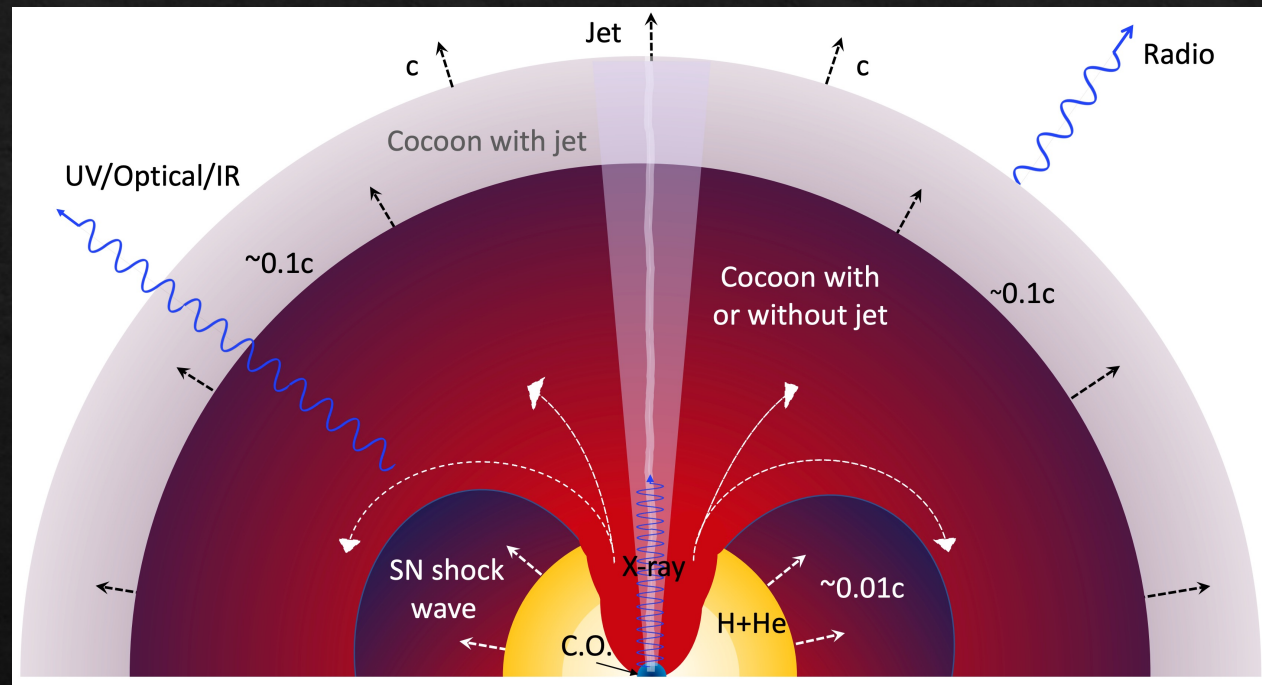
Hidden jets in (L)FBOTs

- Fast rise and decay + asymmetry + broad features → (mildly) relativistic collimated outflow
- Variable X-ray → Central engine (Margutti et al. 2019)
- SSA radio → Dense CSM in star-forming galaxies → stripped envelope (Ib/c) SNe?
- FBOT radio resembles that of GRBs (Coppejans et al. 2020, Ho et al. 2020, Mooley et al. 2021)



Shocked jets do such transients

- Quasi-thermal spectrum
 - Energy: $E_c \approx L_{GRB} \times t_B \approx 10^{50} - 10^{51}$ erg
 - Early rise and fast decay, $L(t) \propto t^{-2.4}$
 - Broad H lines from star outer layer or CSM
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- The diagram illustrates the internal structure of a gamma-ray burst (GRB) source. At the center is a black hole (BH) accretion disk (C.O.). A narrow, highly relativistic jet is launched along the poles of the BH. Surrounding the jet is a larger, more diffuse region labeled "Cocoon with jet". The cocoon is shown in two states: one where it contains the jet and another where it does not. The cocoon's velocity is indicated as $\sim 0.1c$. The jet itself moves at c . The SN shock wave is depicted as a curved surface expanding from the base of the jet. The material between the shock and the jet is labeled "H+He". The velocity of this material is indicated as $\sim 0.01c$. Various radiation types are shown emerging from the system: UV/Optical/IR (blue wavy arrows), X-ray (red wavy arrow), and Radio (blue wavy arrow). The diagram is credited to Gottlieb et al. 2022b.
- Gottlieb et al. 2022b
- Rise in radio originates in the structure of the mildly-relativistic outflow
 - After ~ 3 days the cocoon becomes optically thin to the X-ray photons from the accreting BH



Gottlieb et al. 2022b