華中師範大學
CENTRAL CHINA NORMAL UNIVERSITY

短伽马暴的喷流结构和光度函数

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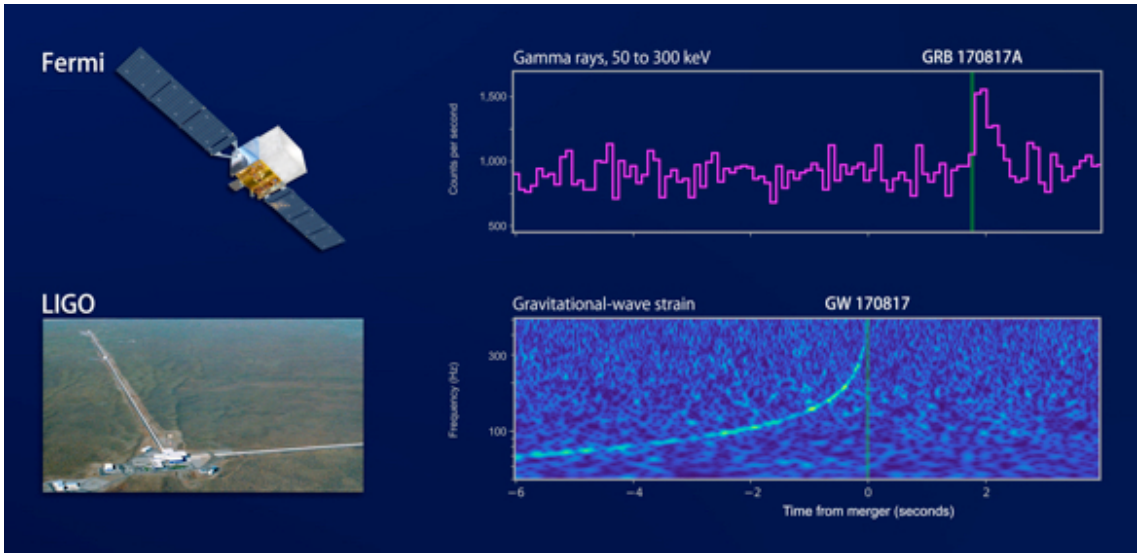
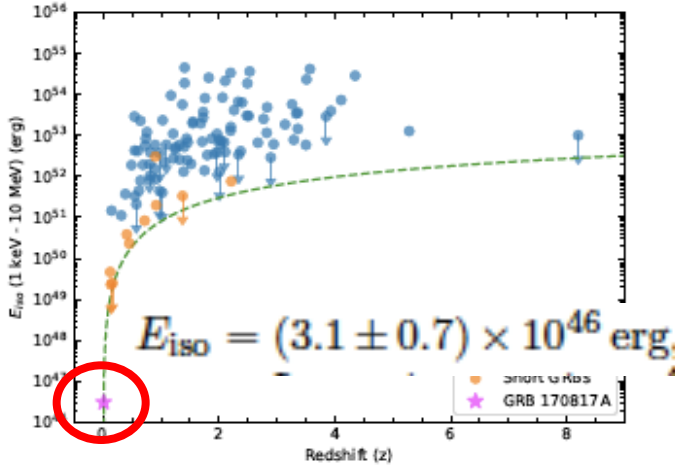
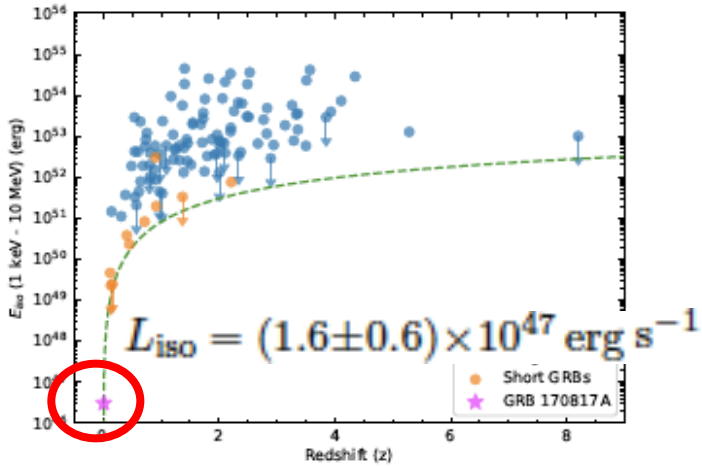
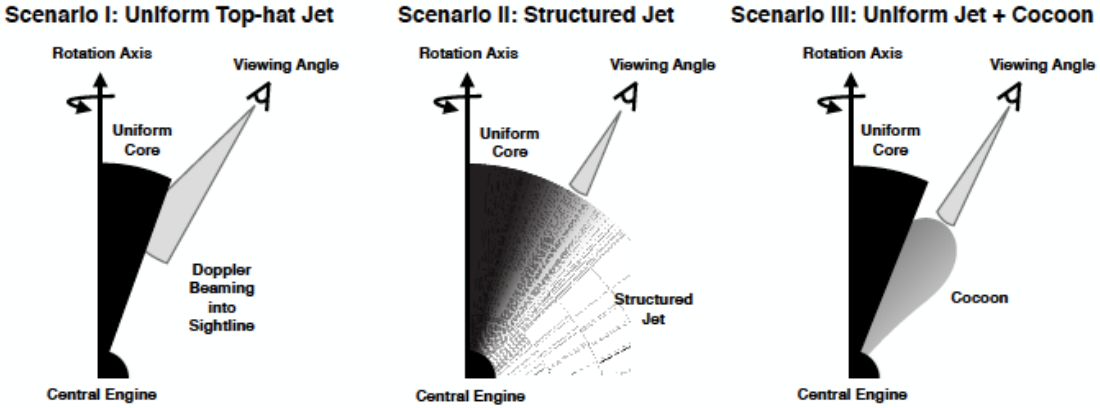
GW170817/GRB 170817A





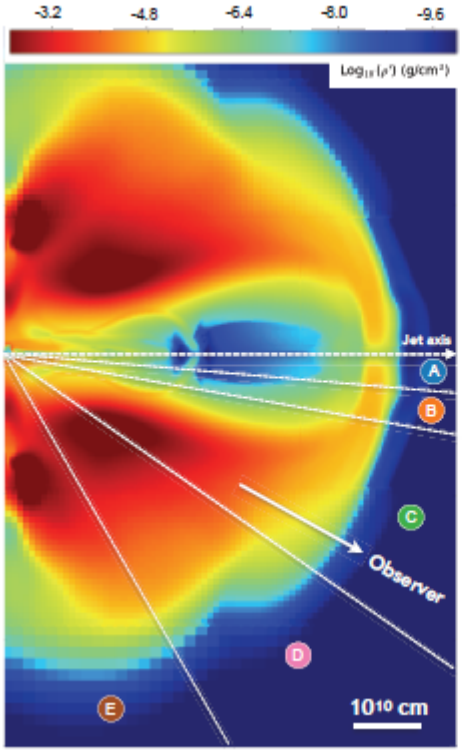


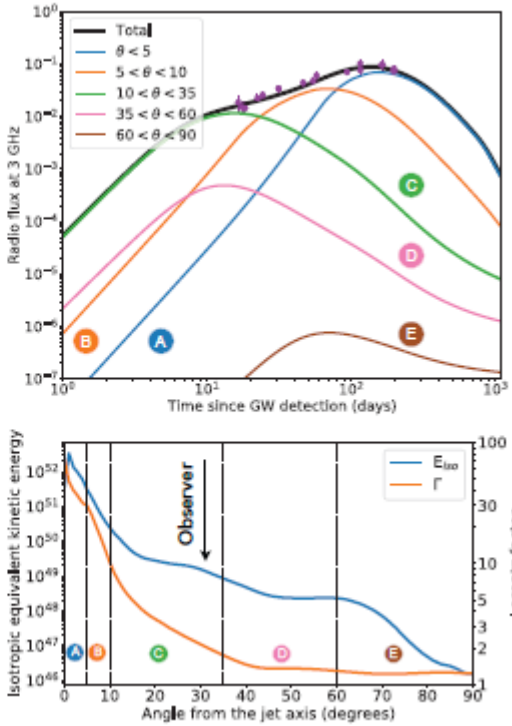
Abbott et al. 1710.05834

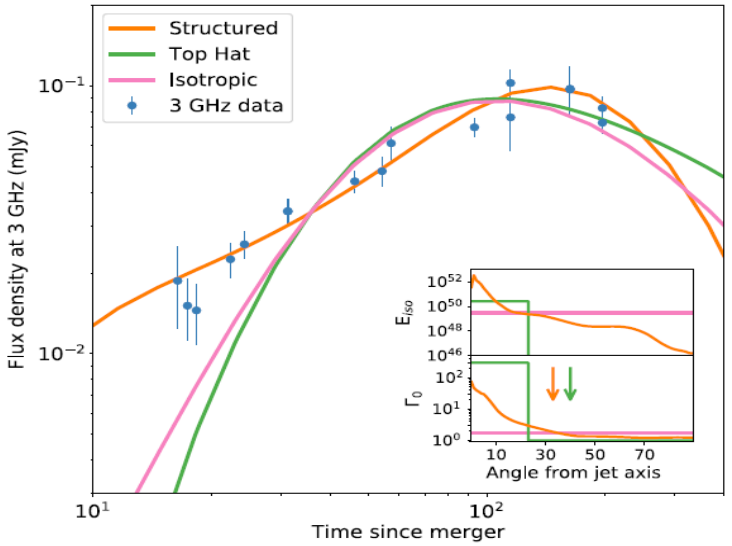


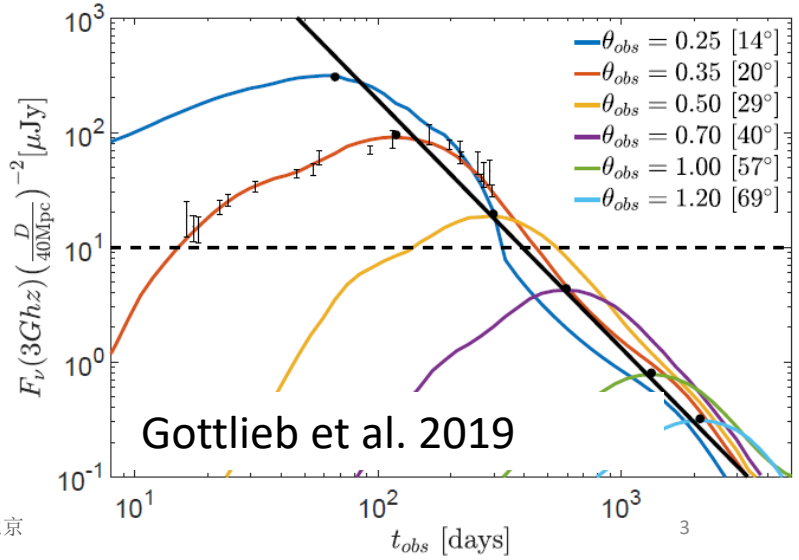
Ioka & Nakamura 1710.05905
Bromberg et al. 1710.05897

Jet structure and off-axis observational afterglows









Lazzati et al. 2018, PRL, 120: 241103

Superluminal motion

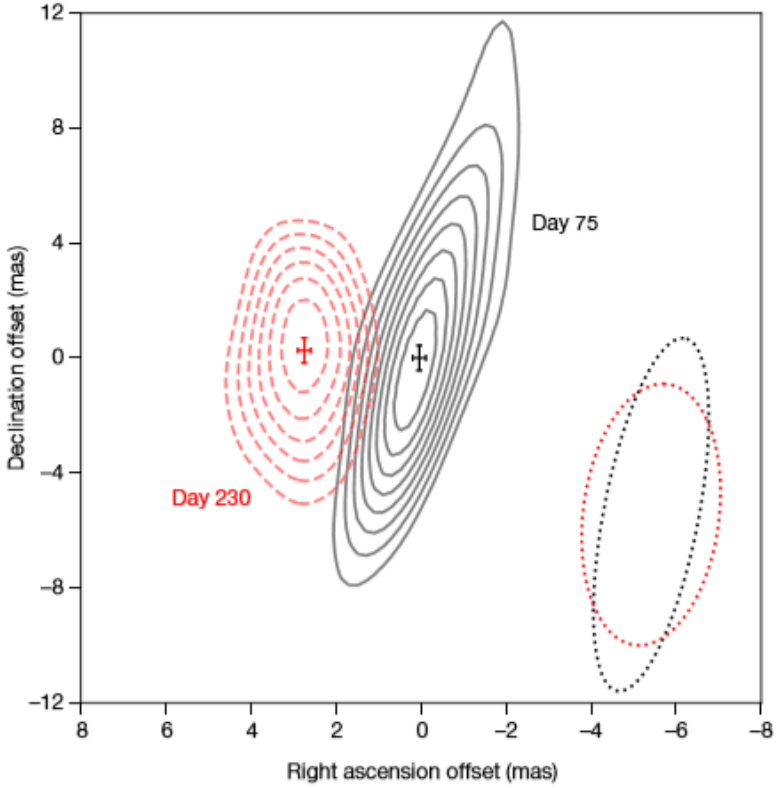
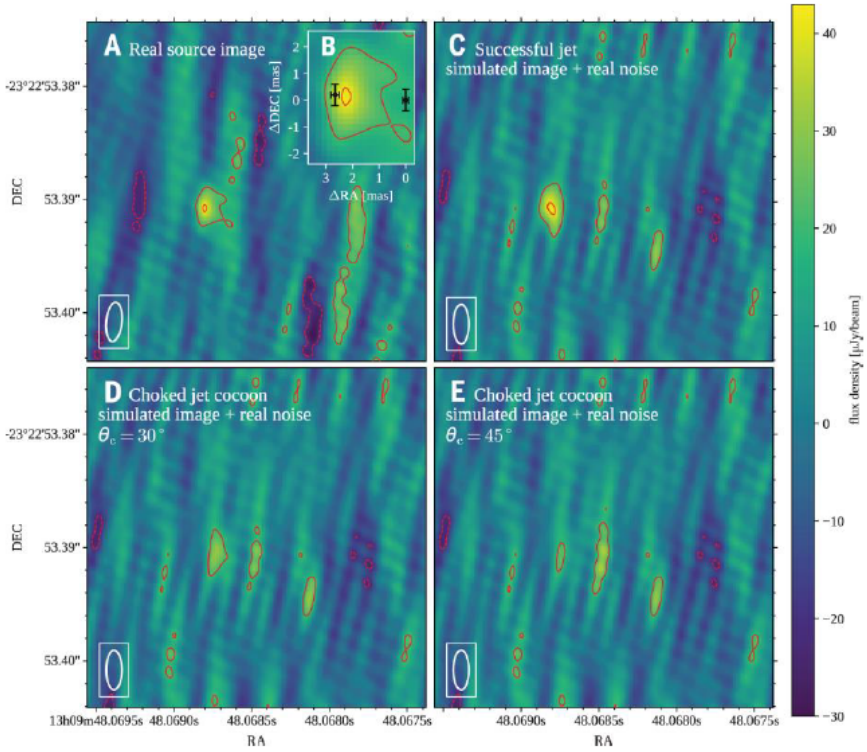


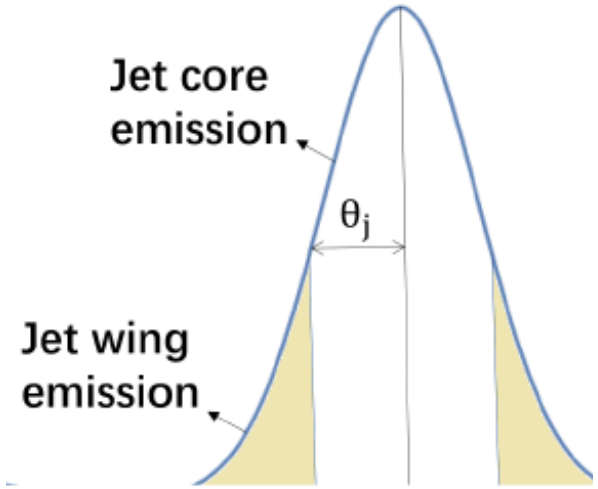
Fig. 1 | Proper motion of the radio counterpart of GW170817. The offset positions of the centroid (shown by 1σ error bars) and 3σ–12σ contours of the radio source detected 75 days (black) and 230 days (red) after the merger event using VLBI at 4.5 GHz. The two VLBI epochs have

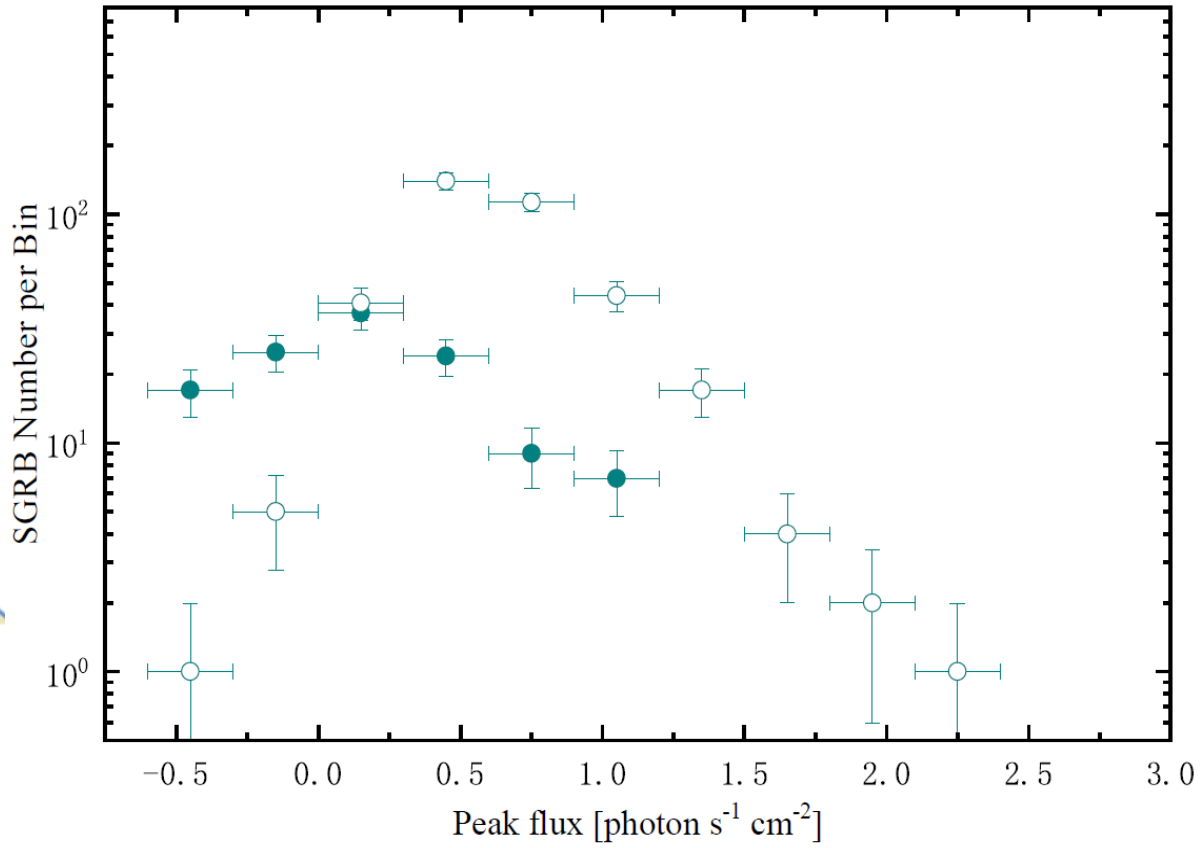
Mooley et al. 2018, Nature, 561: 355



Ghirlanda et al. 2019, Science, 363: 968

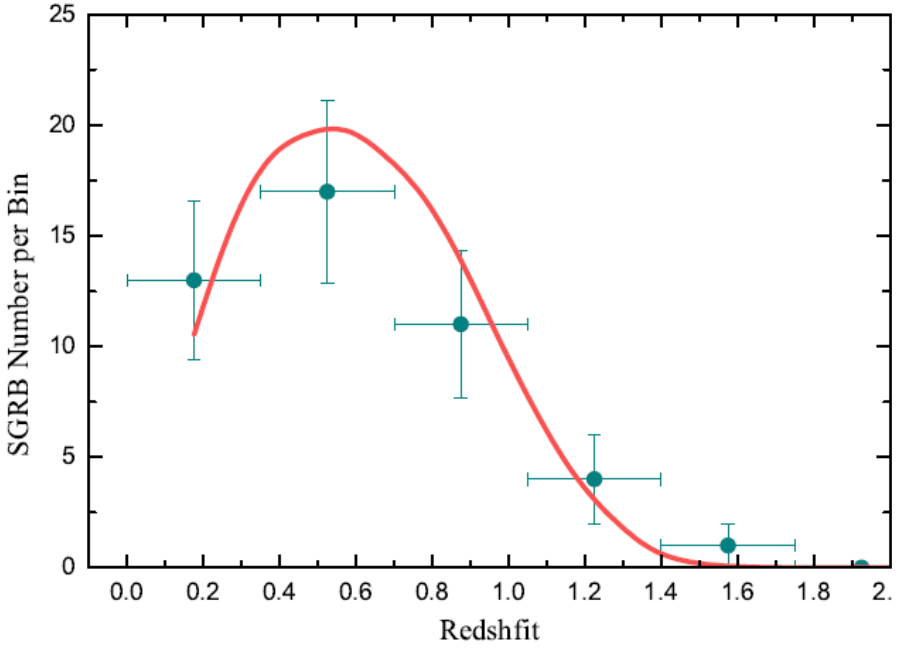
Jet Sturcture

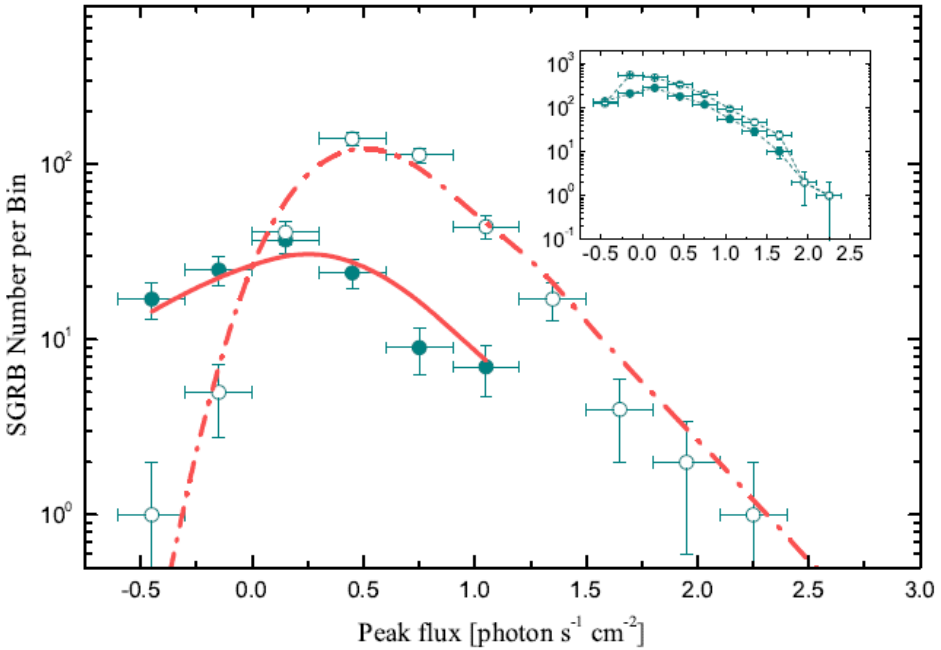




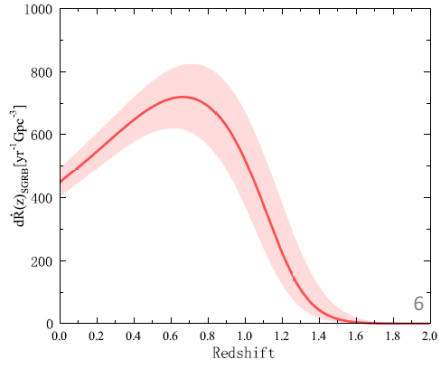
Flux and redshift distributions of cosmological SGRBs

Tan & **Yu** 2020, ApJ, 902, 83

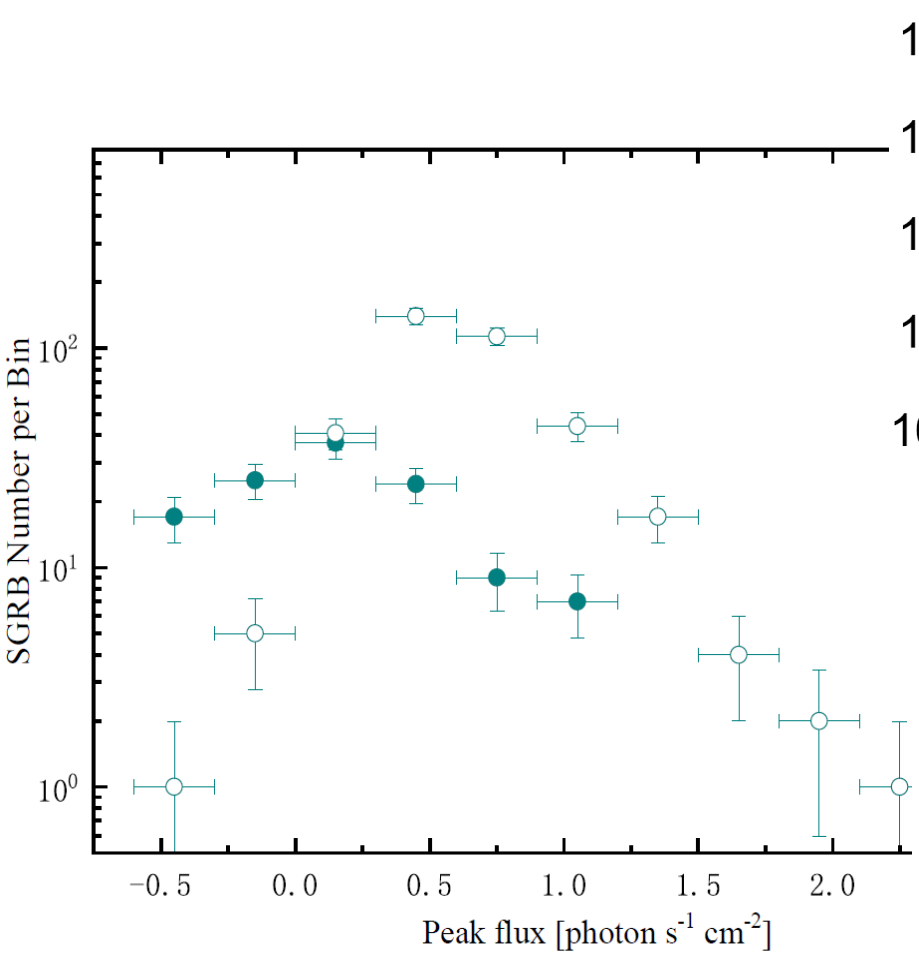


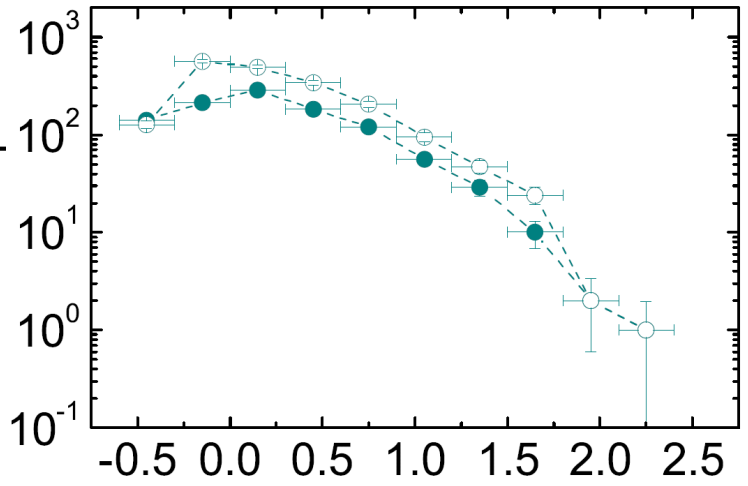


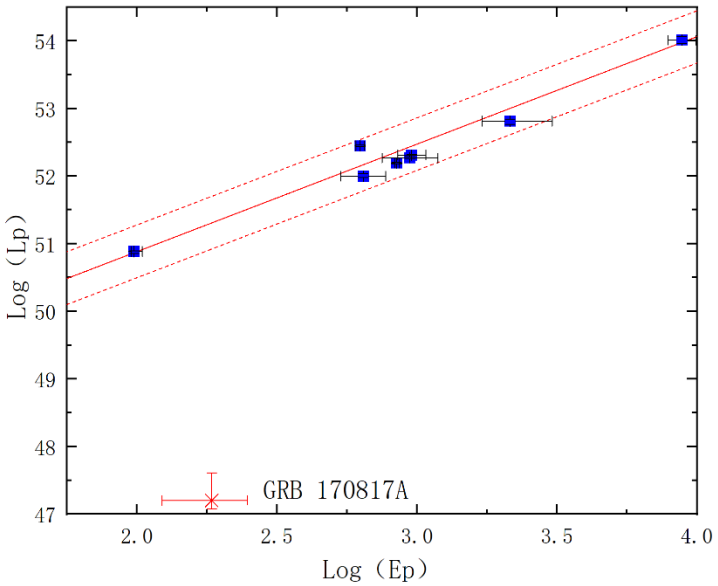
$$N(P_1,P_2)=\frac{\Delta\Omega}{4\pi}T\int_0^{z_{\max}}\int_{P_1}^{P_2}\int_0^{\theta_{\rm v,max}}\dot{R}_{\rm SGRB}(z)\Phi(L_c)\times\eta(P)\sin\theta_{\rm v}\,d\theta_{\rm v}dP\frac{dV(z)}{1+z},\qquad(5)$$



Flux distribution and sensitivity





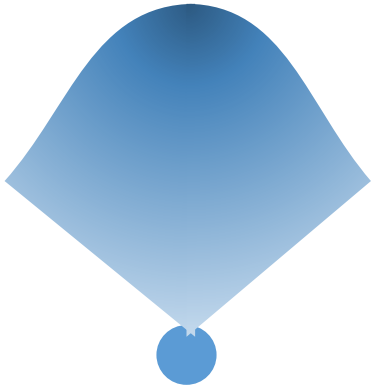


Jet structure and luminosity functions

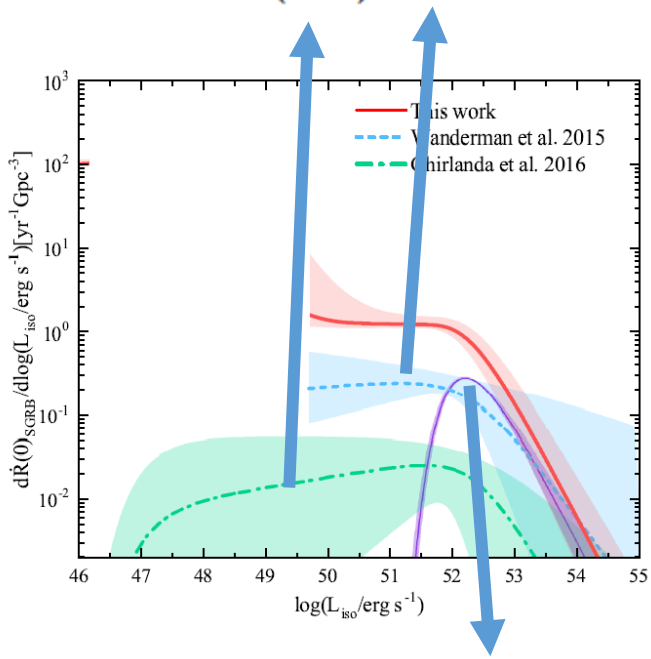
Top-hat jet

Gaussian jet

$$L_{\rm iso}(\theta_{\rm v}) = L_{\rm in,p} \exp\left(-\frac{\theta_{\rm v}^2}{2\theta_{\rm in}^2}\right)$$



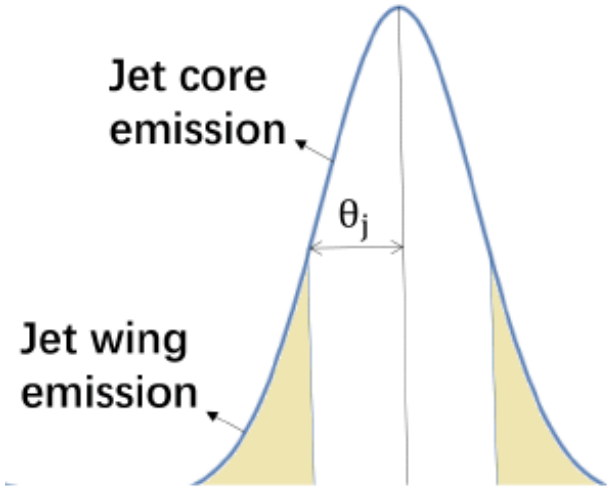
$$\Phi(L) \propto \begin{cases} \left(\frac{L}{L_{\rm b}}\right)^{-\nu_1}, & L < L_{\rm b}, \\ \left(\frac{L}{L_{\rm b}}\right)^{-\nu_2}, & L \geq L_{\rm b}. \end{cases}$$

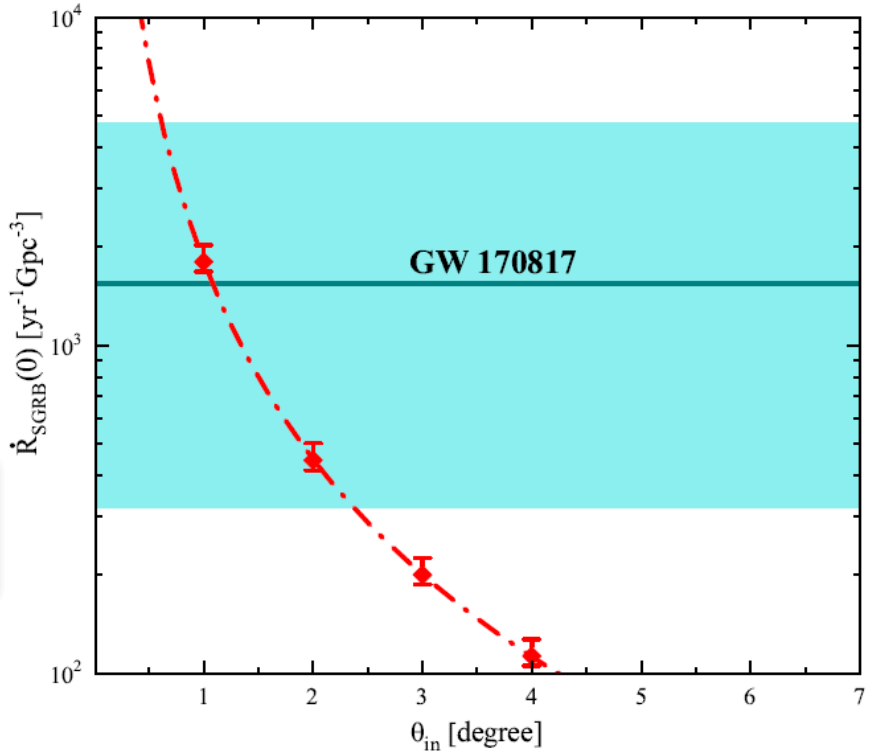


$$\Phi(L_{\rm c}) = \Phi_* \left(\frac{L_{\rm c}}{L_{\rm c}^*}\right)^{-\gamma} \exp\left(-\frac{L_{\rm c}^*}{L_{\rm c}}\right)$$

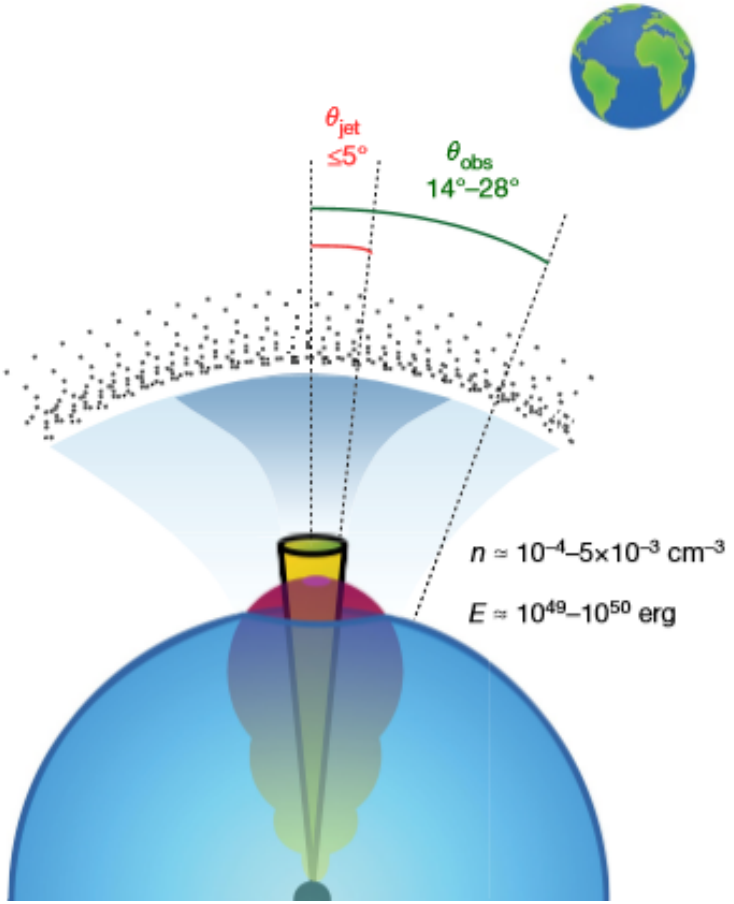
Parameter constraints

Tan & **Yu** 2020, ApJ, 902, 83

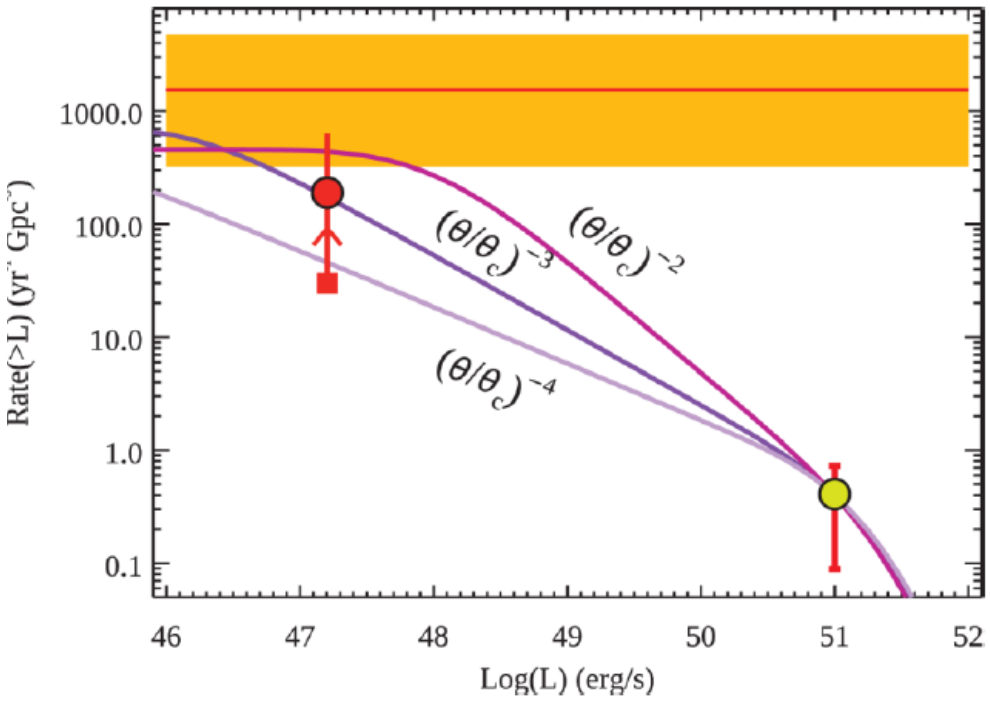




Jet structure and GRB rate



Mooley et al. 2018, Nature, 561: 355



Ghirlanda et al. 2019, Science, 363: 968

Parameter constraints

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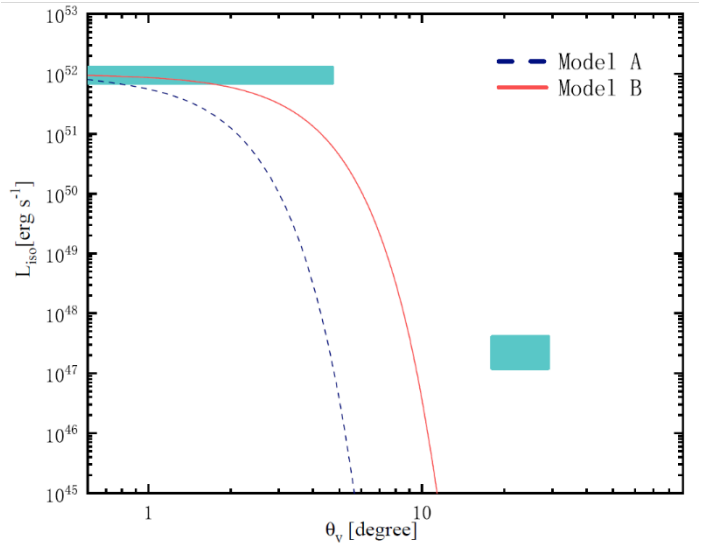
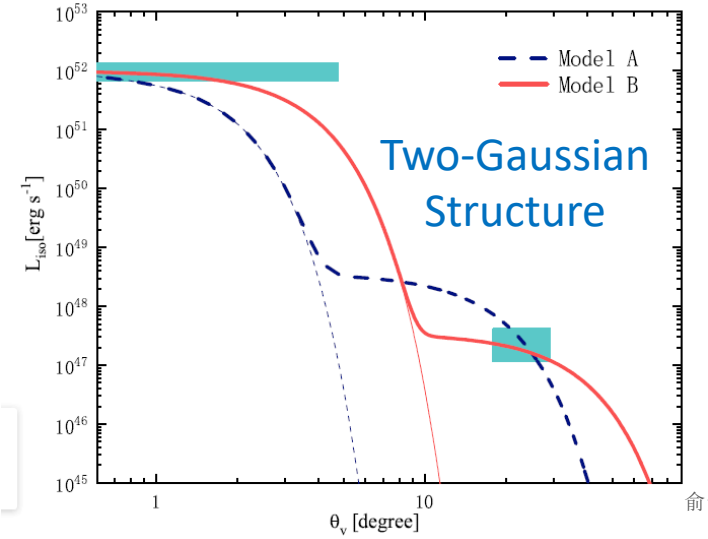
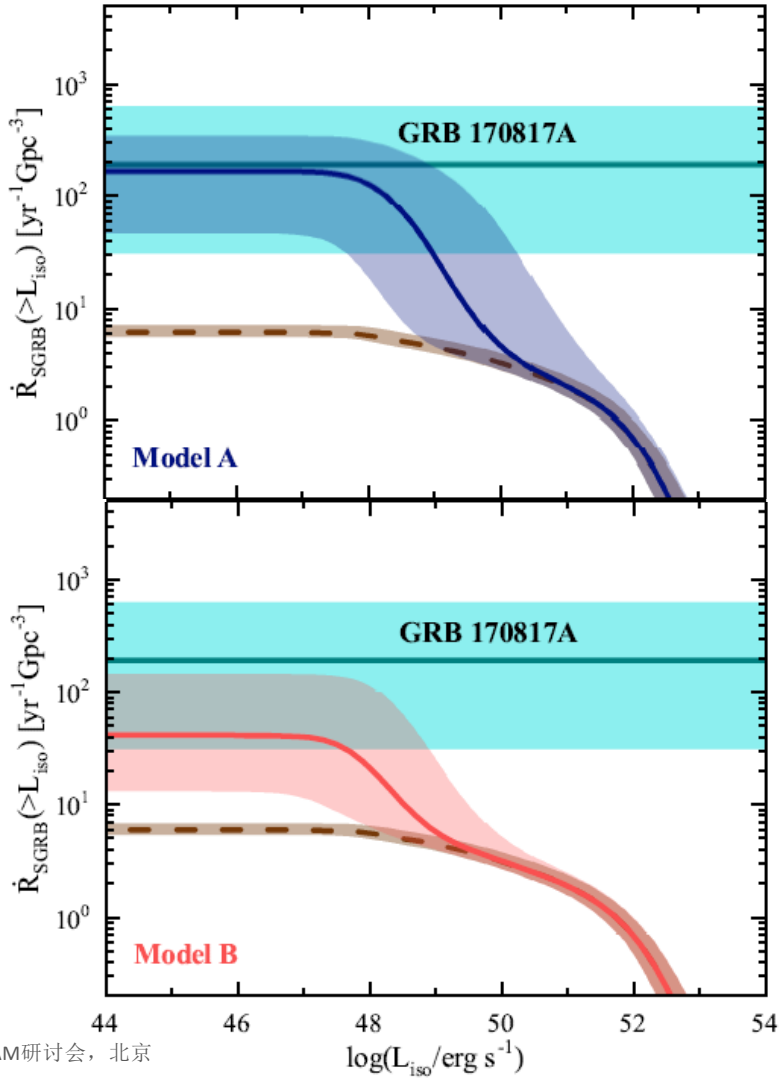
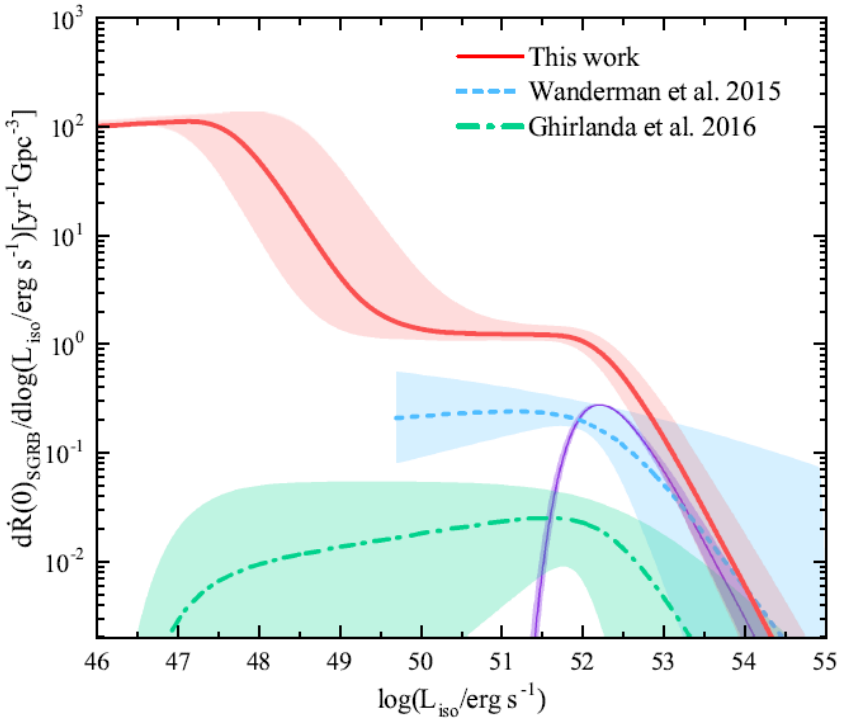


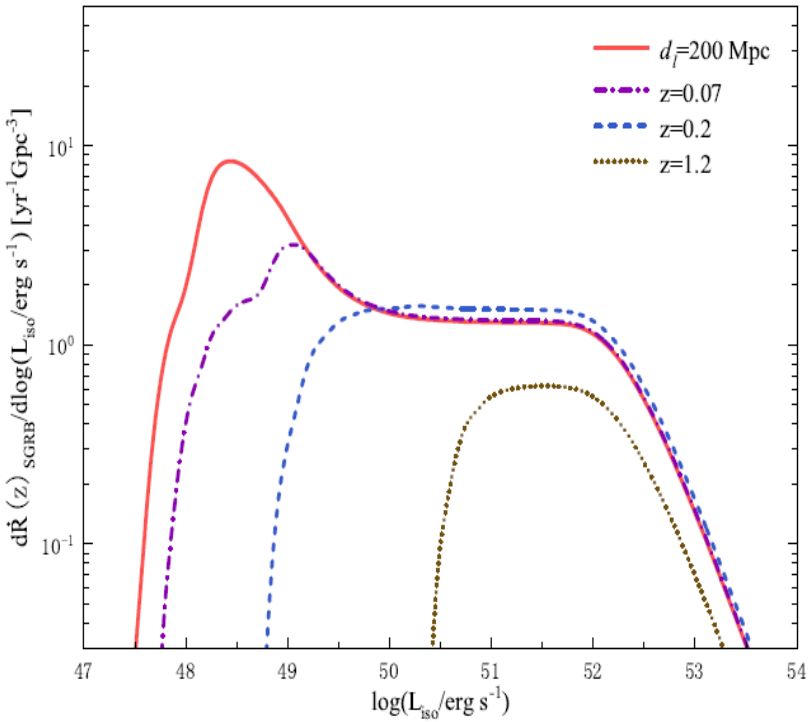




Luminosity functions

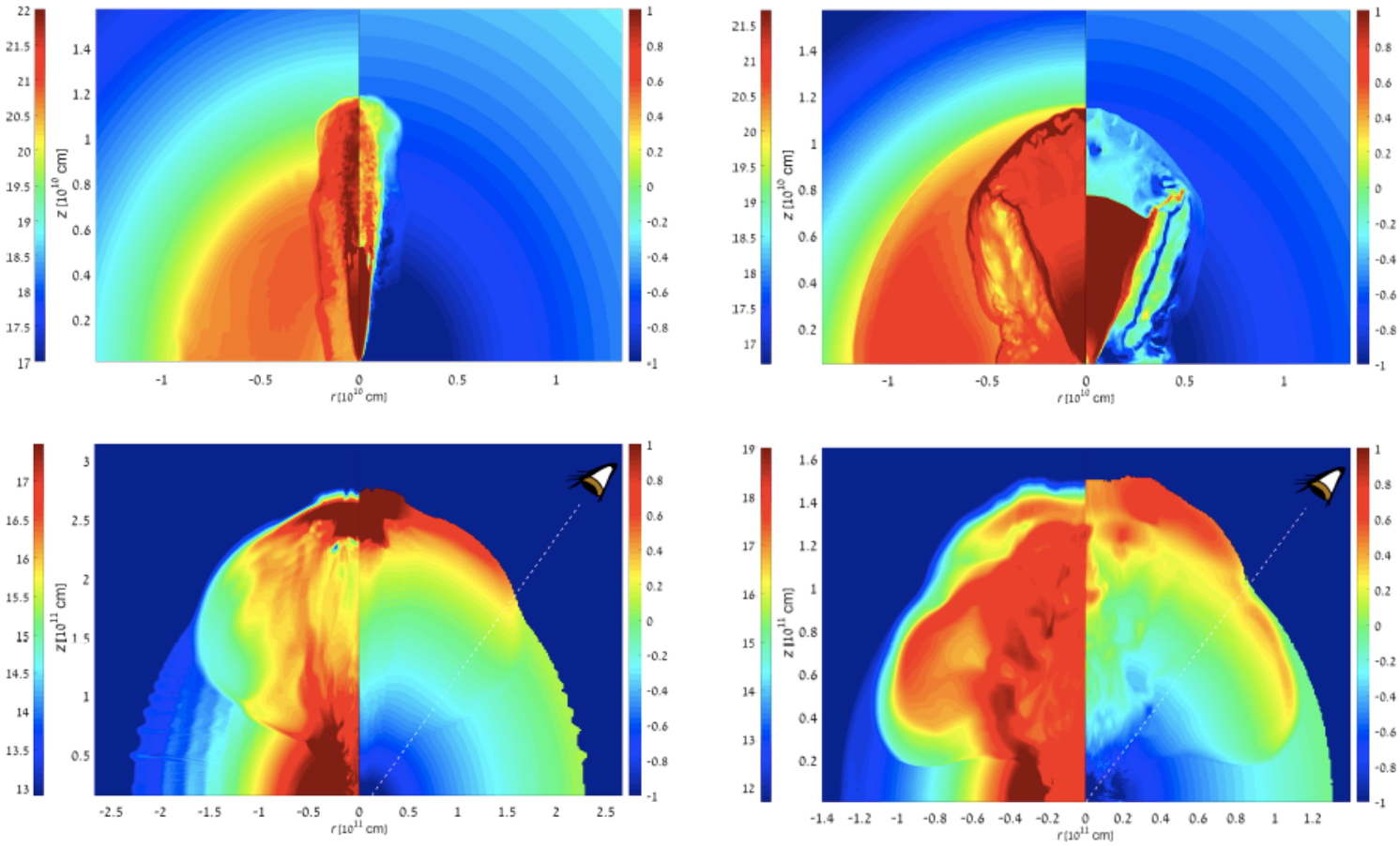
Tan & **Yu** 2020, ApJ, 902, 83





Jet breakout

Gottlieb et al. 2018, MNRAS, 479, 588



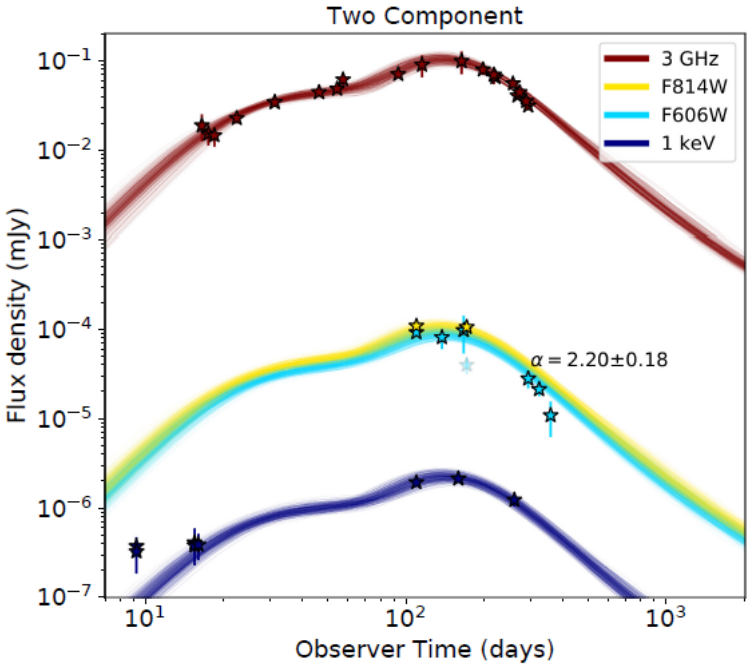
GECAM expectation

The detectable number per year of the GW-associated SGRBs for GECAM [42].

Model	<100 Mpc	<200 Mpc	<300 Mpc
A	$0.9^{+0.6}_{-0.4}$	$7.9^{+4.7}_{-3.3}$	$20.9^{+15.4}_{-10.7}$
B	$0.4^{+0.4}_{-0.2}$	$3.3^{+2.8}_{-1.4}$	$9.3^{+9.1}_{-4.4}$

Two-component afterglow model

- The broadband afterglow is consistent with a structured outow where an ultra-relativistic jet, with Lorentz factor, ~100, forms a narrow core (5º) and is surrounded by a wider angular component that extends to 15º, which is itself relativistic (Gamma>5).



Lamb et al., 2019, ApJ, 870, L15