To constrain NS's EoS by GRB X-ray plateau

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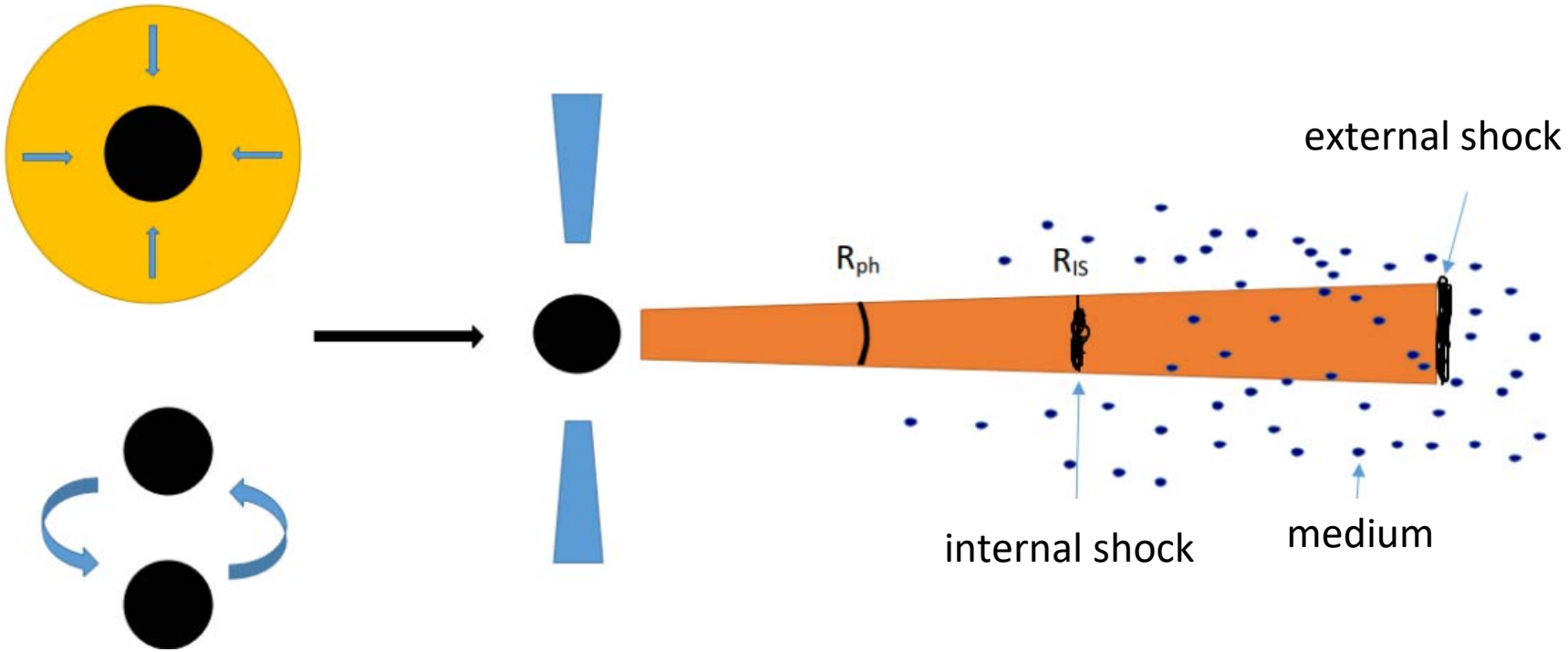
What is a GRB?



The remnant may be a neutron star/magnetar

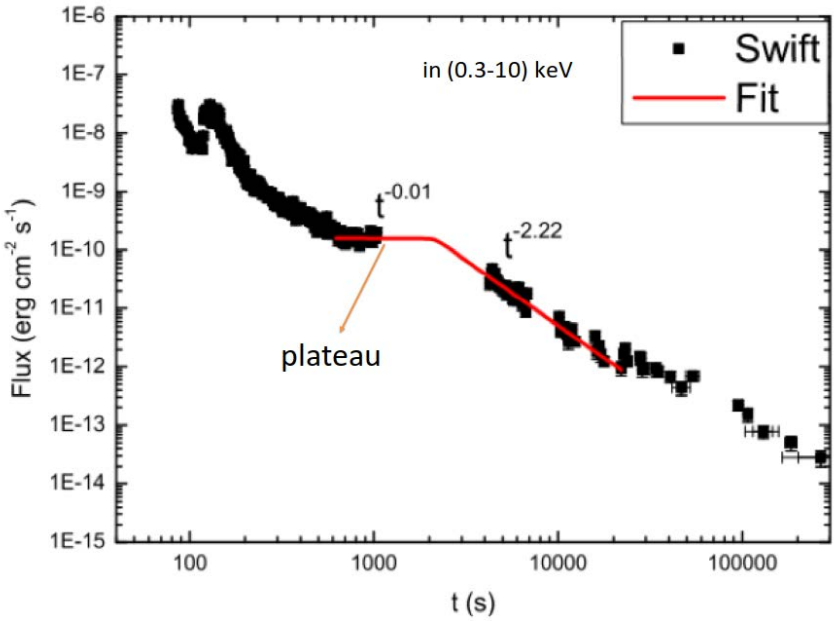
Spin down of the neutron star:

$$I\Omega\dot{\Omega} = -\frac{B_{\rm eff}^2 R^6 \Omega^4}{6c^3}$$

$$L_{\rm sd}(t) = L_{\rm sd,0}\left(1+\frac{t}{\tau_{\rm em}}\right)^{-2}$$

$$\tau_{\rm em} = \frac{3c^3 I}{B_{\rm eff}^2 R^6 \Omega_0^2}$$

Observation of the afterglow of GRB 080607



Du, Zhou, Xu, arXiv: 1905.01655, ApJ accepted

Result

$$I > 1.0 \times 10^{45} \left(\frac{P_{\rm cri}}{1\ {\rm ms}} \right)^2\ {\rm g \cdot cm^2}.$$

for rotational inertia

$B_{\rm eff,max}$ (10^{15}Gs)	$P_{\rm cri}$ (ms)	R (10^5cm)
1.0	0.5	> 8.7
1.0	1.0	> 11.0
2.5	0.5	> 6.4
2.5	1.0	> 8.1
$B_{\rm eff,max}$ (10^{15}Gs)	P_0 (ms)	R (10^5cm)
1.0	1.5	> 12.5
2.5	1.5	> 9.2
1.0	2.0	> 13.8
2.5	2.0	> 10.2

for equatorial radius

Summary

- The constraint is weak due to the narrow-energy-range observation (0.3-10 keV). It is easy to be improved, e.g., 0.1-30 keV.

- This is a new method. It can be combined with the constraint of gravitational waves.

Thanks