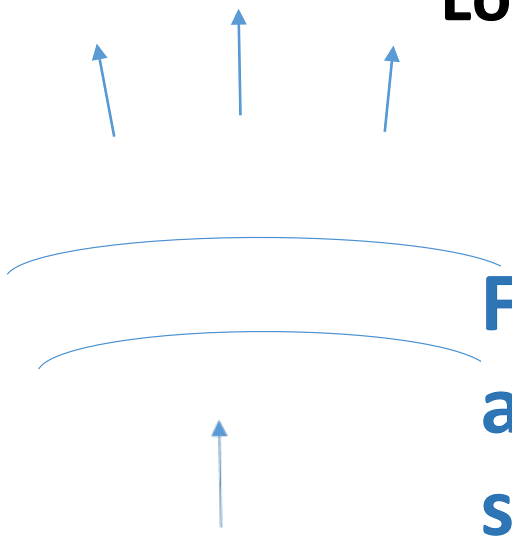
CAN ULTRASAT SEE PROMPT GRB EMISSION?

DE with Mukesh Vyas and Asaf Pe’er

Need about 10^{-7} of bright GRB in near UV photons.

WIDELY HELD GRB MODEL:

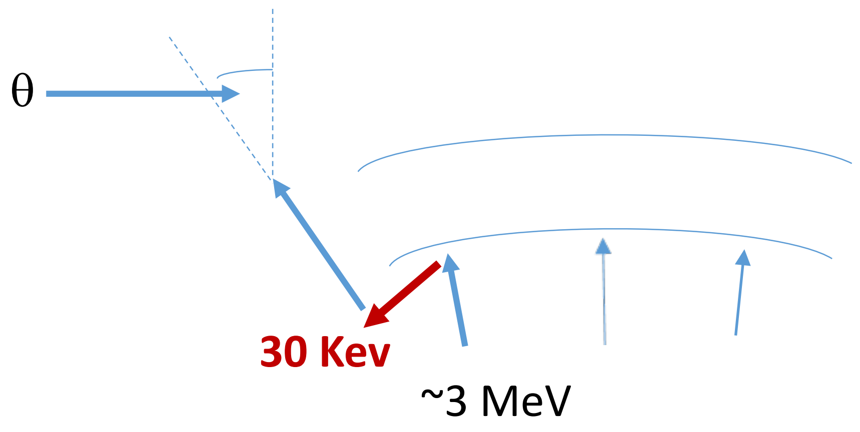
Lorentz factor ~ 100



Fireball temperature about 0.5 KeV gives spectral peak of ~280 KeV.

CHAMPAGNE CORK GRB MODEL:

Lorentz factor ~ 100



Baryonic cork from host star pushed by GRB flash from central engine. Gamma rays (which are ~30 KeV X-rays in frame of cork) reflect off back end into obliquely backward direction. Blue shifted into observer's frame to

$30\,\text{KeV}/\Gamma(1-\beta\cos\theta) \sim 60\Gamma\,\text{KeV}/(1+\theta^2\Gamma^2) \sim 280$ KeV

Figure 5 from Three-dimensional Simulations of Long Duration Gamma-ray Burst Jets: Timescales from Variable Engines
D. López-Cámara et al. 2016 ApJ 826 180 doi:10.3847/0004-637X/826/2/180

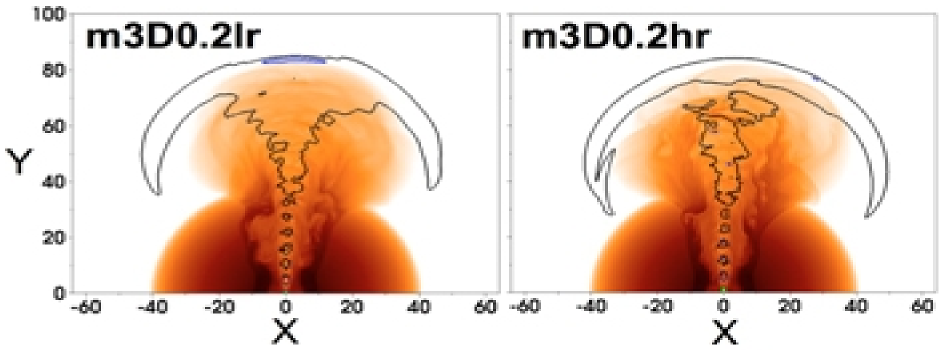


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Figure 7 from Three-dimensional Simulations of Long Duration Gamma-ray Burst Jets: Timescales from Variable Engines
D. López-Cámara et al. 2016 ApJ 826 180 doi:10.3847/0004-637X/826/2/180

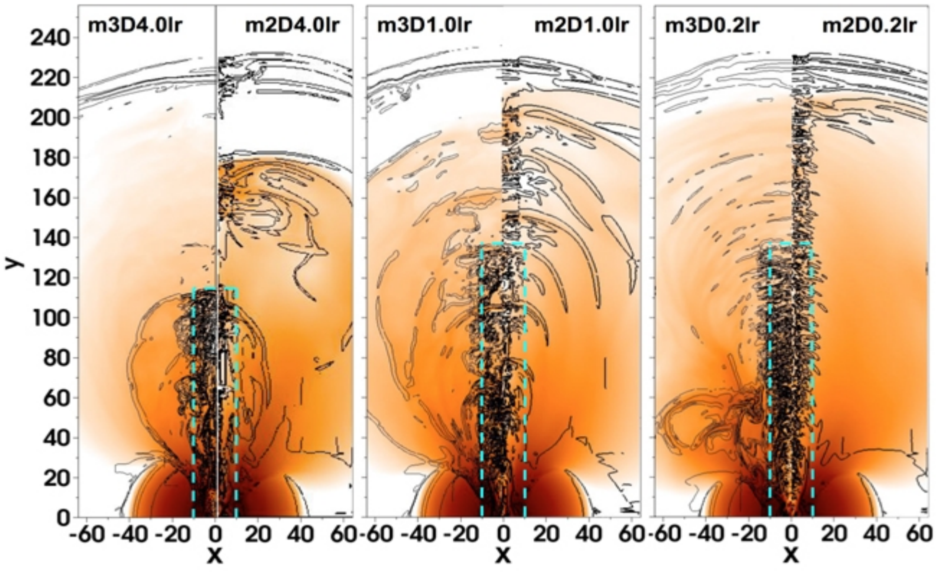

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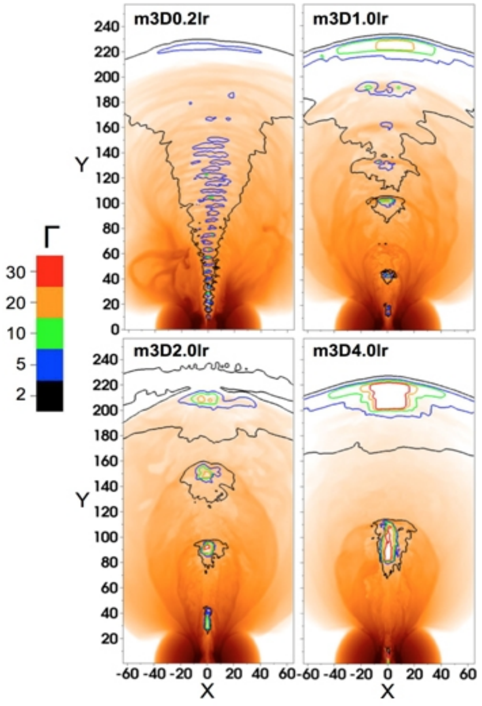
Figure 3 from Three-dimensional Simulations of Long Duration Gamma-ray Burst Jets: Timescales from Variable Engines
D. López-Cámara et al. 2016 ApJ 826 180 doi:10.3847/0004-637X/826/2/180



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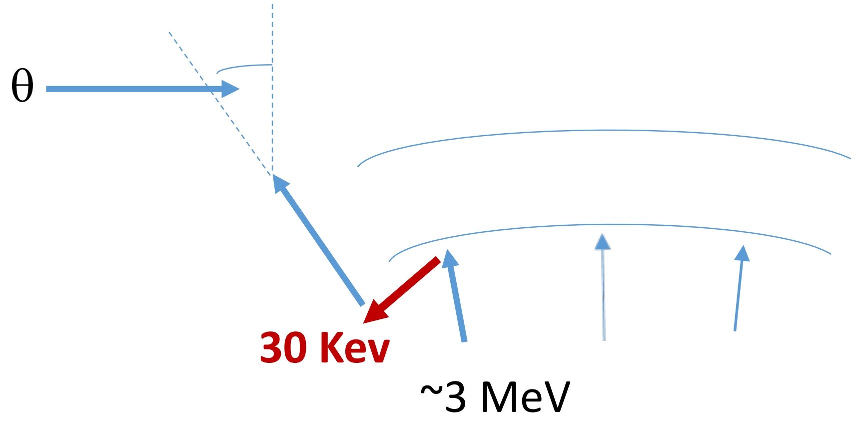
CHAMPAGNE CORK GRB MODEL:

Lorentz factor ~ 100



But **what about heating of the cork?**

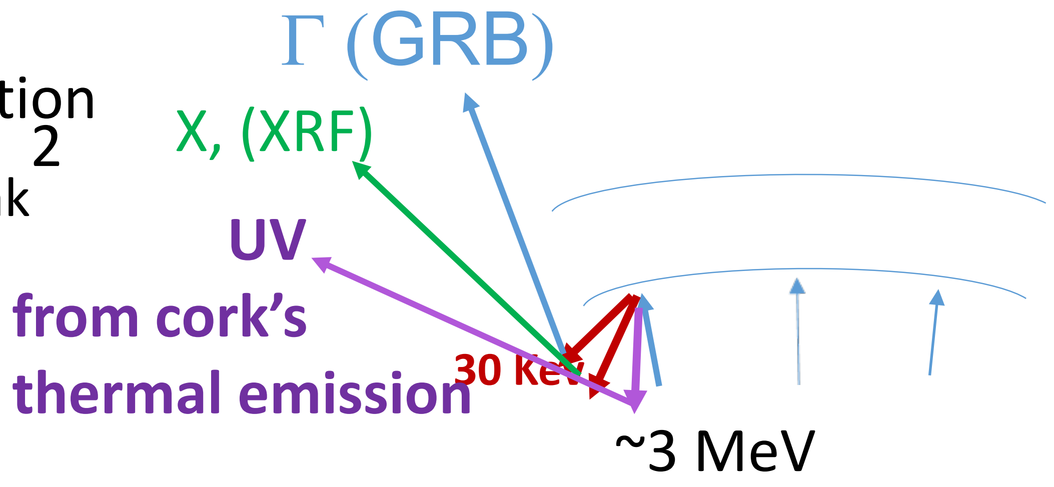
The cork gets heated by (at least) Compton recoil to T ~ 1 KeV and it gets more than ½ of total energy.

CHAMPAGNE CORK GRB MODEL:

Lorentz factor ~ 100

Amati relation

$E_{iso} = KE_{peak}^{2}$



Assuming Amati relation holds down to photons energies of 5 eV (ULTRASAT range), then

$E_{iso} \sim (5\ eV/1\ KeV)^{2}$ x GRB $E_{iso} > 10^{-5}$ of GRB E_{iso}.

So maybe....detectable UV emission

**Note that the UV emission,
which is thermal emission from the cork, may be accompanied by *scattered* primary photons, which would appear as an X-ray flash (XRF).**