Effects of Jet-Ejecta Interaction on Kilonova Light Curves

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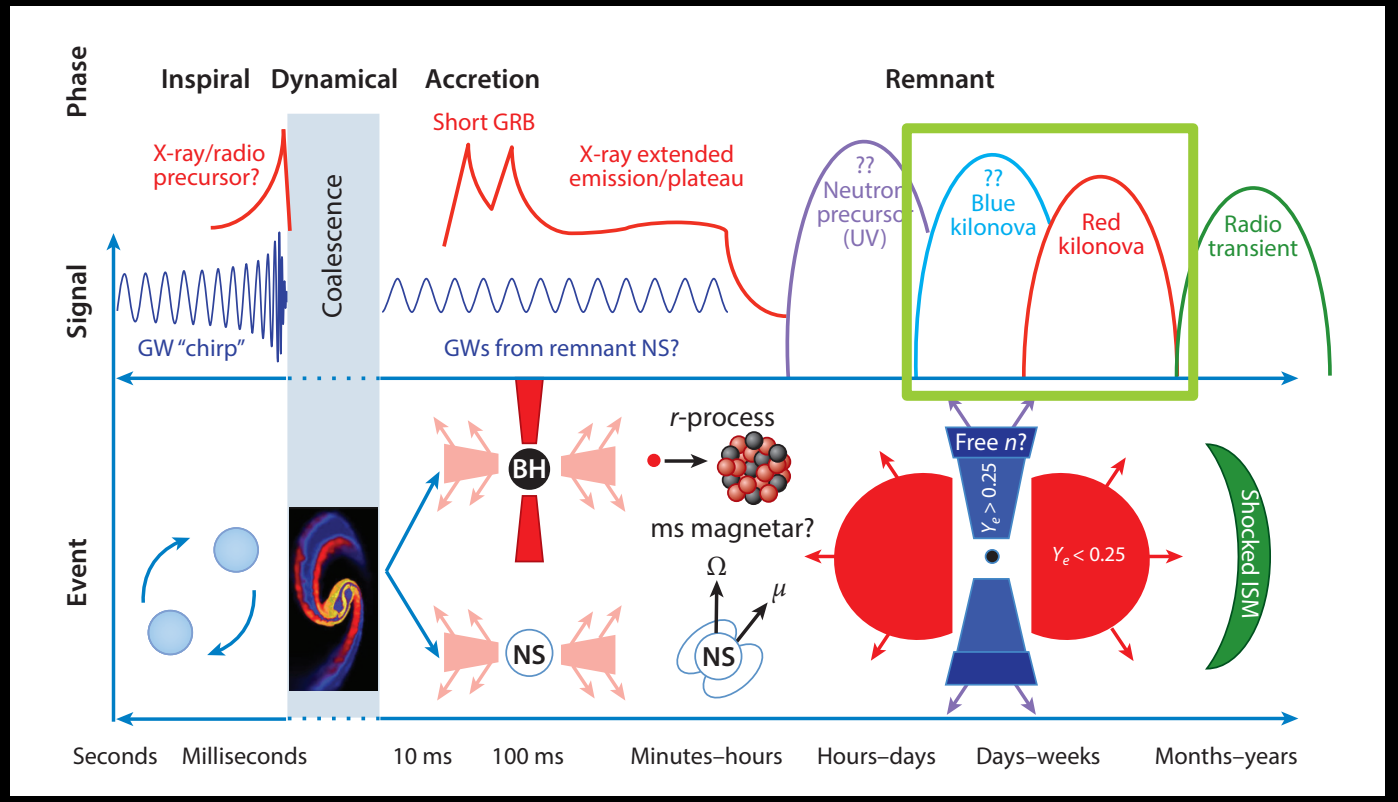
Neutron Star Merger Observables



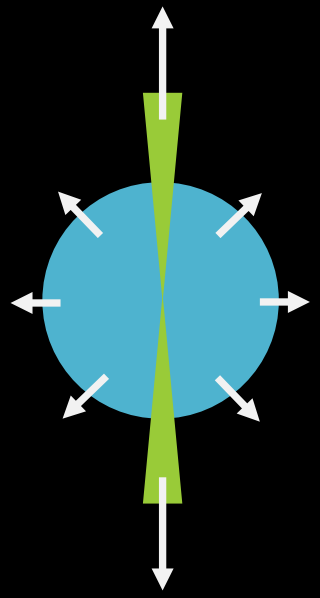
Fernández & Metzger '16

How Does Jet-Ejecta Interaction Affect Kilonova?

Focusing on **shock-heating** due to a prompt jet and **changes to density structure**

Approach

t ~ 10 ms to t ~ 100 s

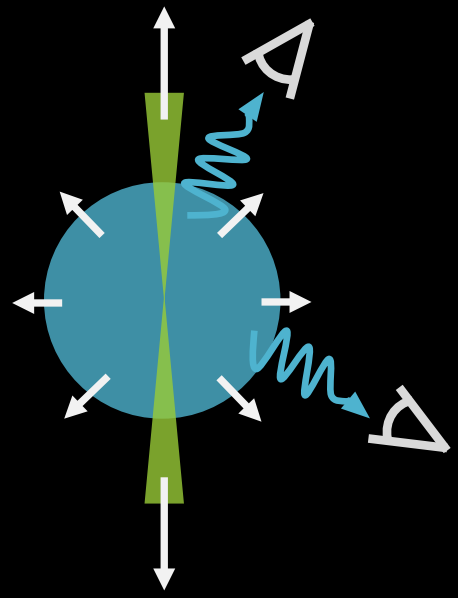


adiabatic expansion

r-process heating

(Metzger+'10, Lippuner & Roberts '15)

t ~15 min to t ~ 10 days



Hydro simulation of jet interacting with expanding outflow

(Duffell + (incl **HK**) '18)

2D Monte Carlo radiation transport simulations with Sedona

Two (of the) Possible Sources of Heating

Prompt shock heating (from jet?)

(incl. Kasliwal+'17, Piro & Kollmeier'17)

~seconds

10^{49} - 10^{50} erg

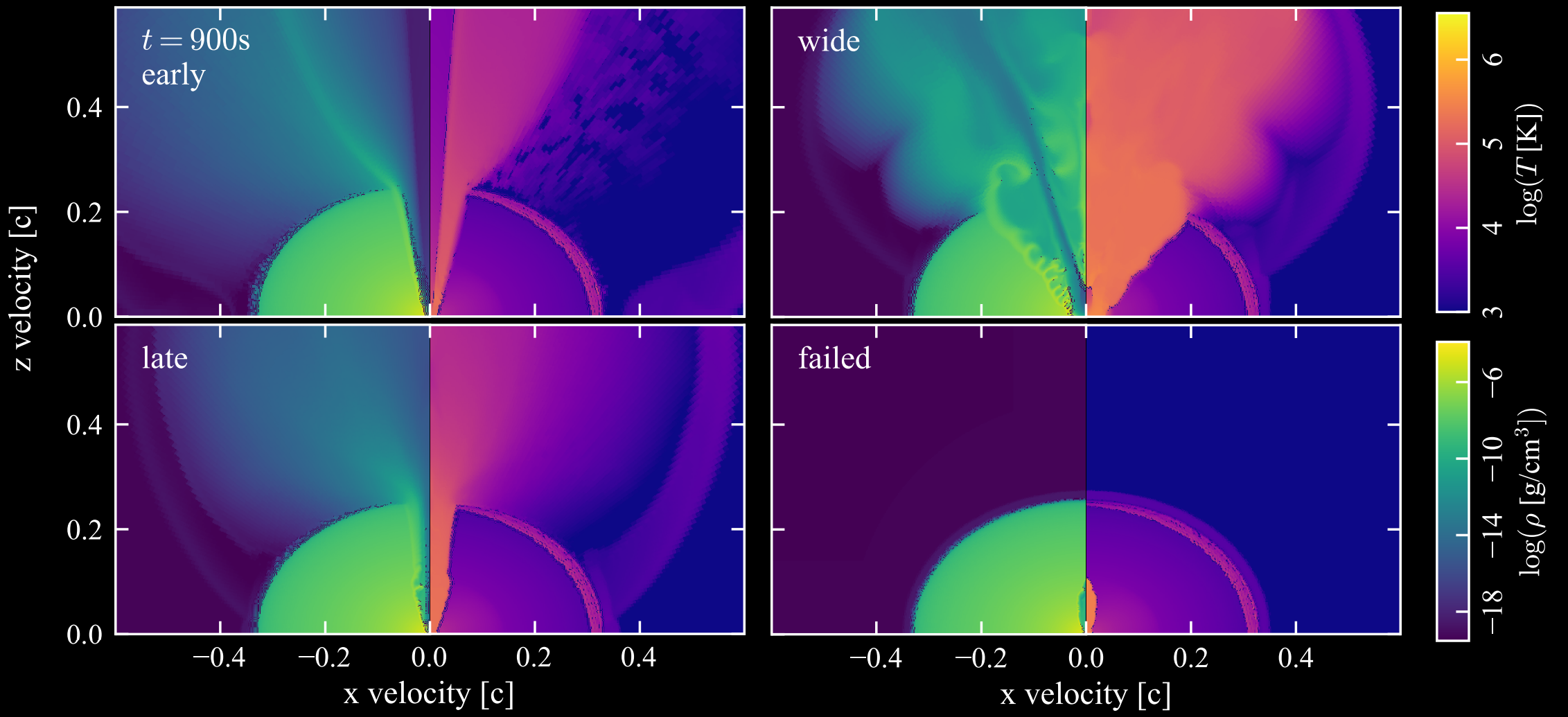
Radioactive decay of nucleosynthesis products

(incl. Metzger+'10)

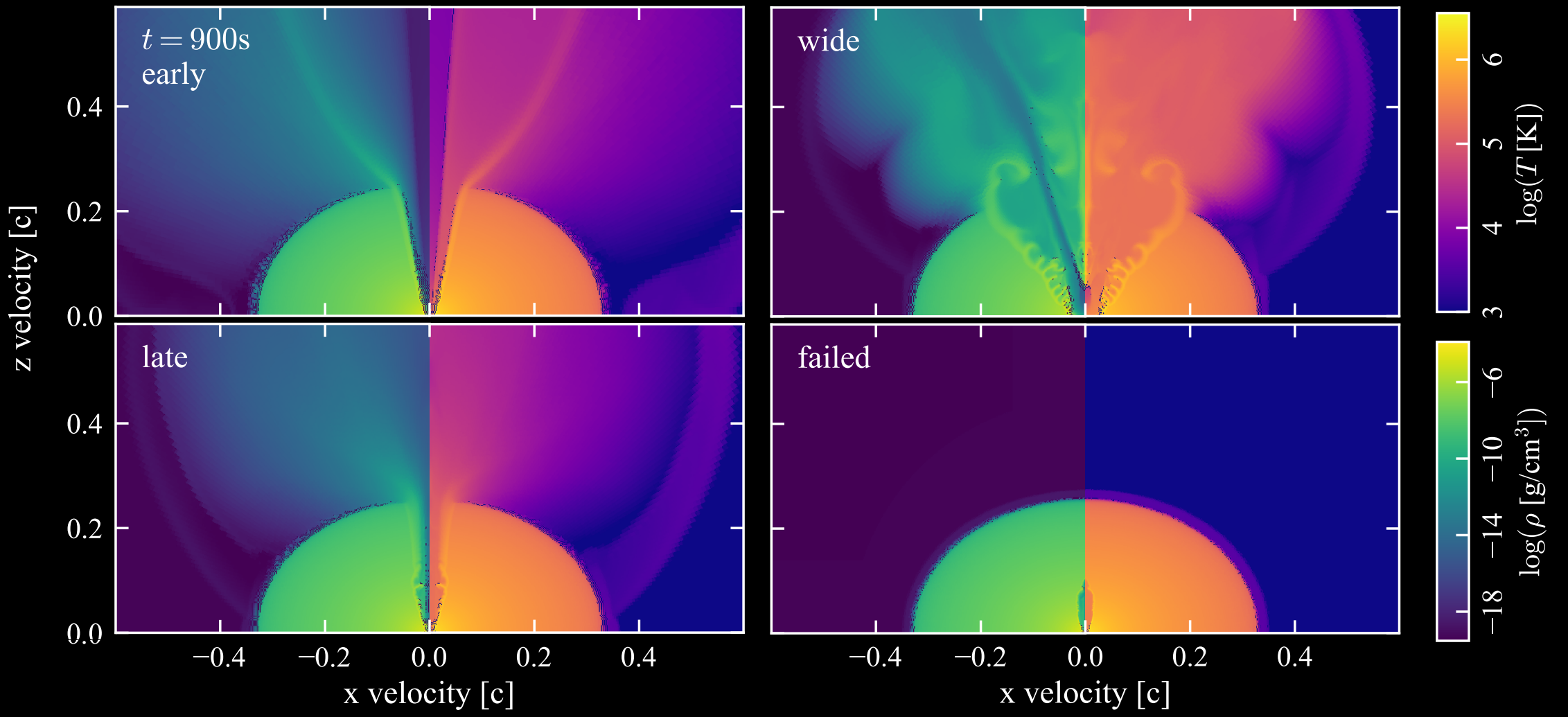
~seconds to days

10^{50} erg

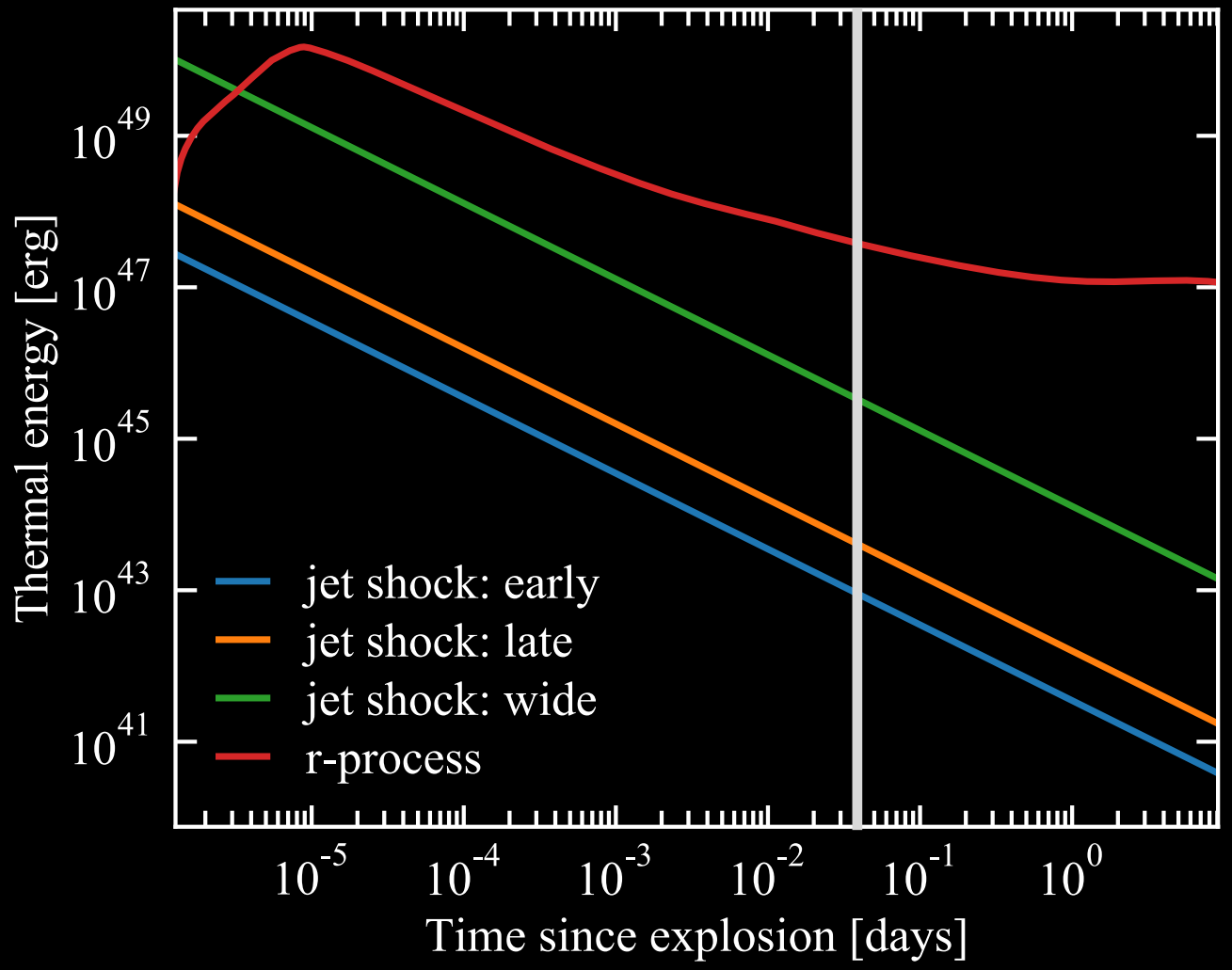
Input Models



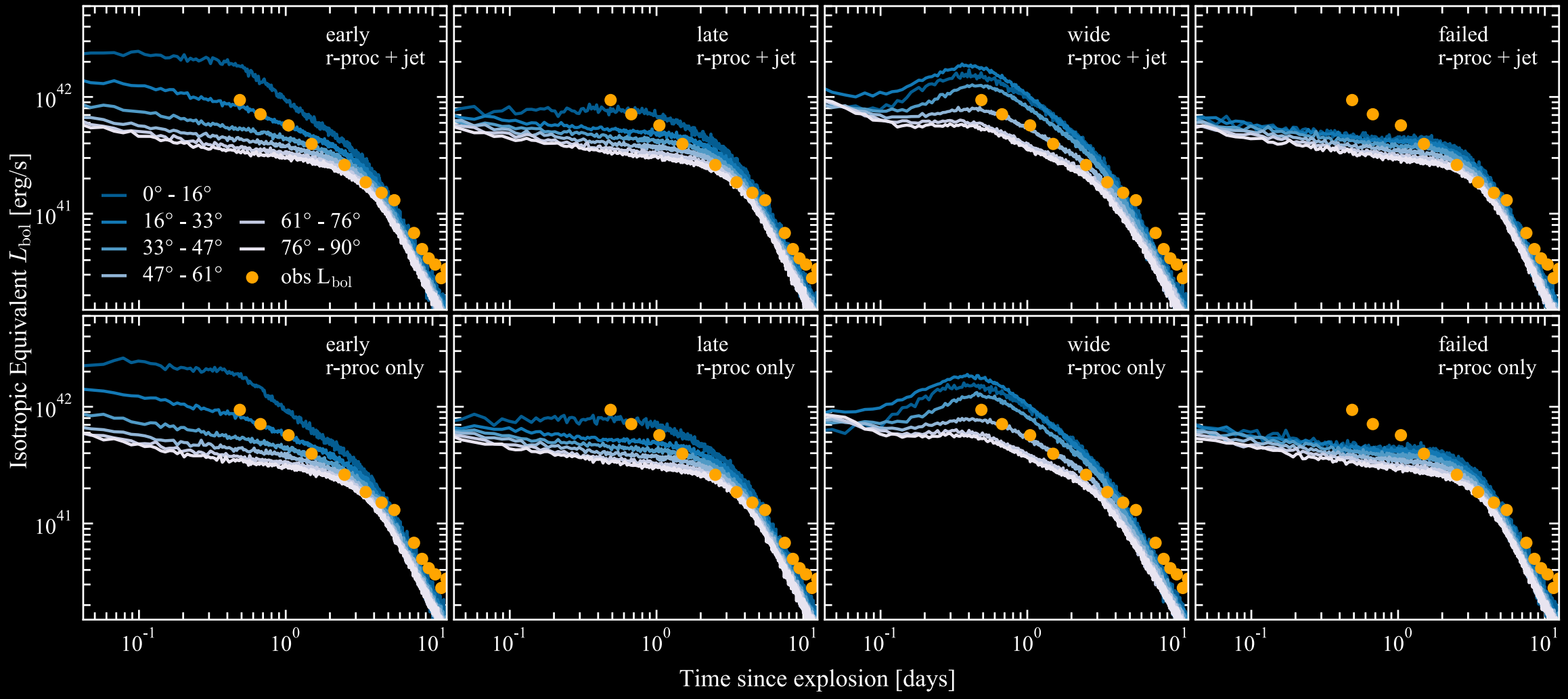
Input Models + r-process



Jet vs Radioactive Thermal Energy



Angle-Dependent Light Curves



obs L_{bol} from Drout + ‘17

HK + ’19, in prep

Summary & Future Directions

Unlikely that light curve is dominated by (prompt jet) shock heating

R-process heating greatly exceeds shock heating, particularly after ~1h.

Jet changes the structure of the ejecta, giving viewing-angle effects that depend on jet energy and opening angle

Push simulations back into first hour (enabled by ongoing improvements to Sedona radiation transport schemes)

Realistic line opacities for iron group and r-process elements