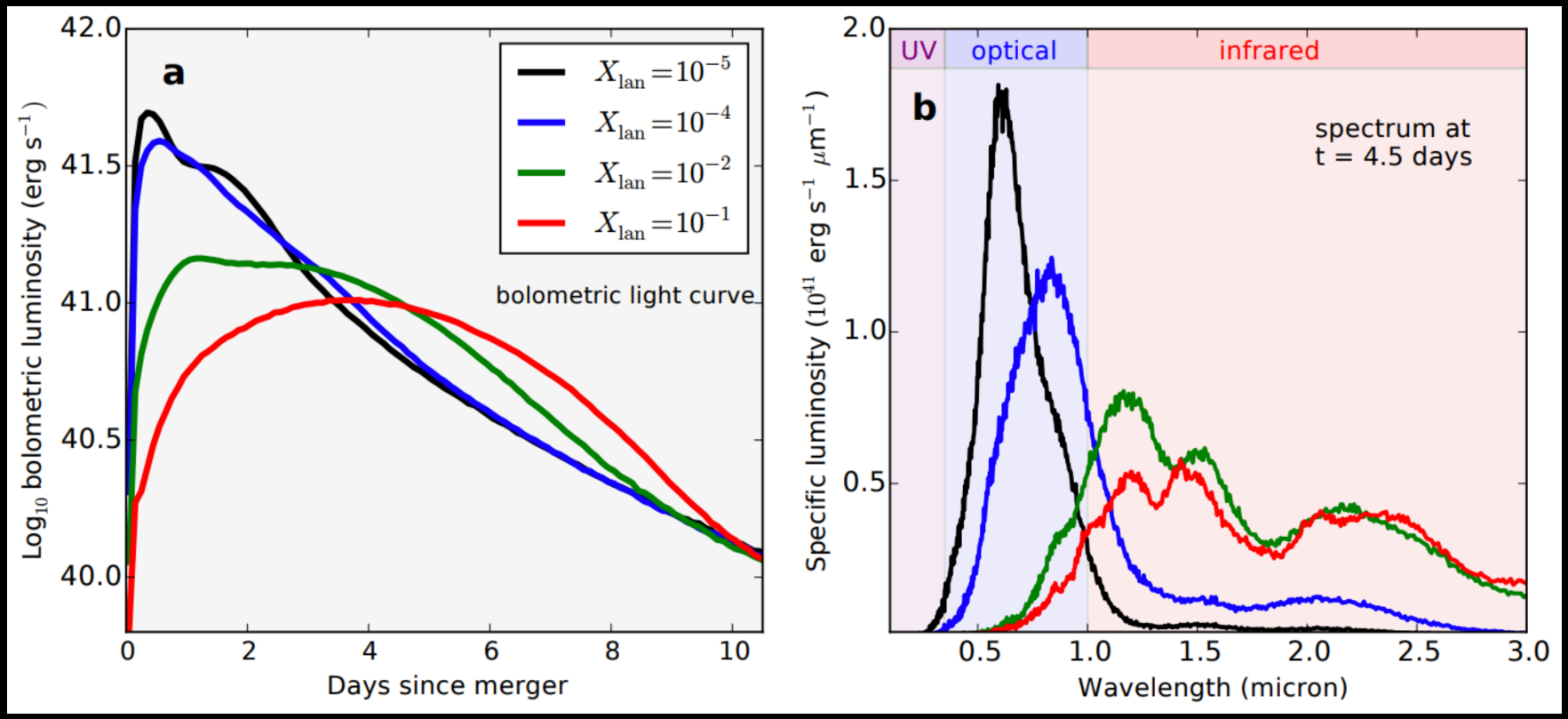
Optical and UV Photometry from the GW170817 Kilonova

SSS17a / AT 2017gfo / DLT17ck / PS17egl / EM170817…

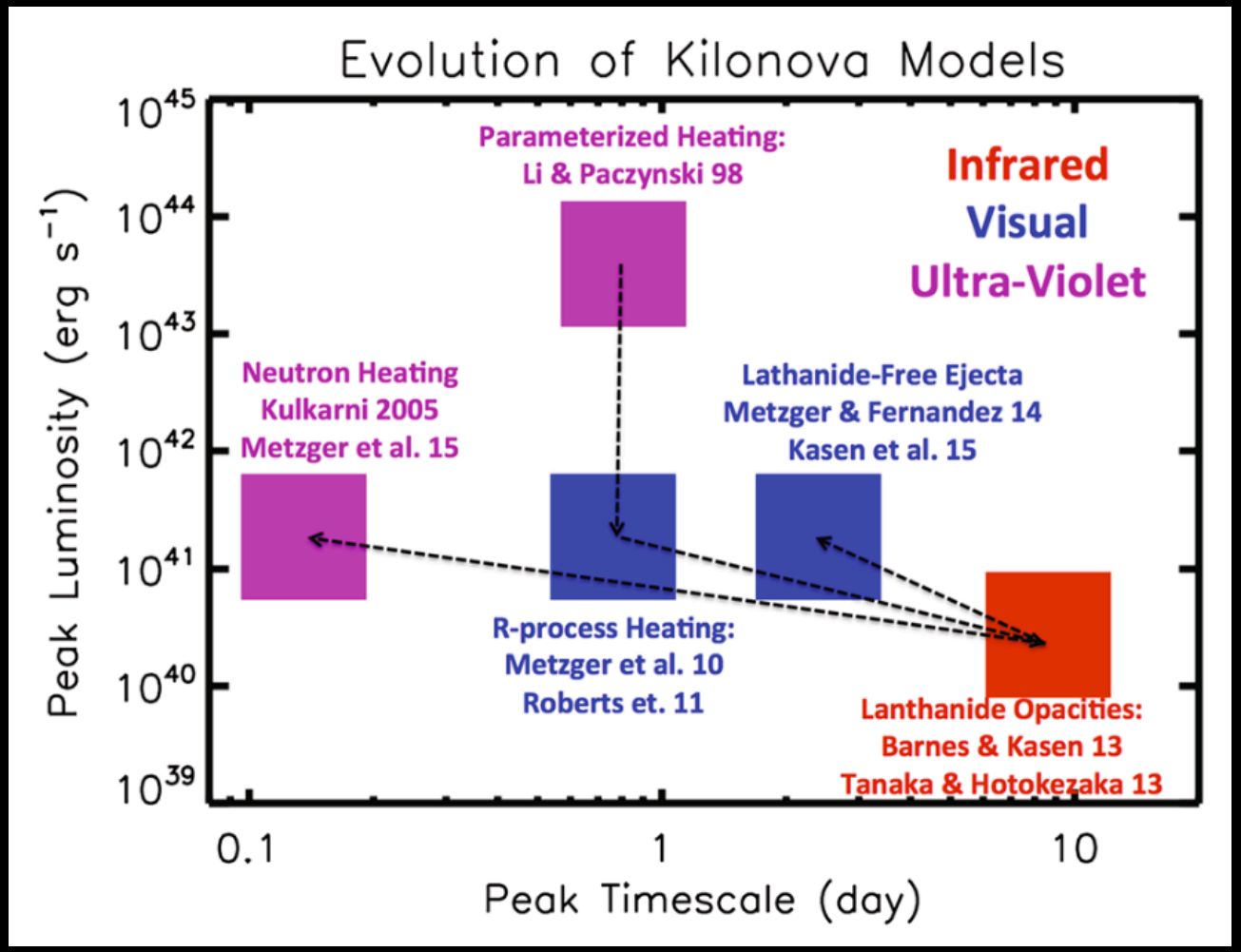
Iair ("ya-eer") Arcavi
UC Santa Barbara & Las Cumbres Observatory

Kilonova Predictions Uncertain due to Composition



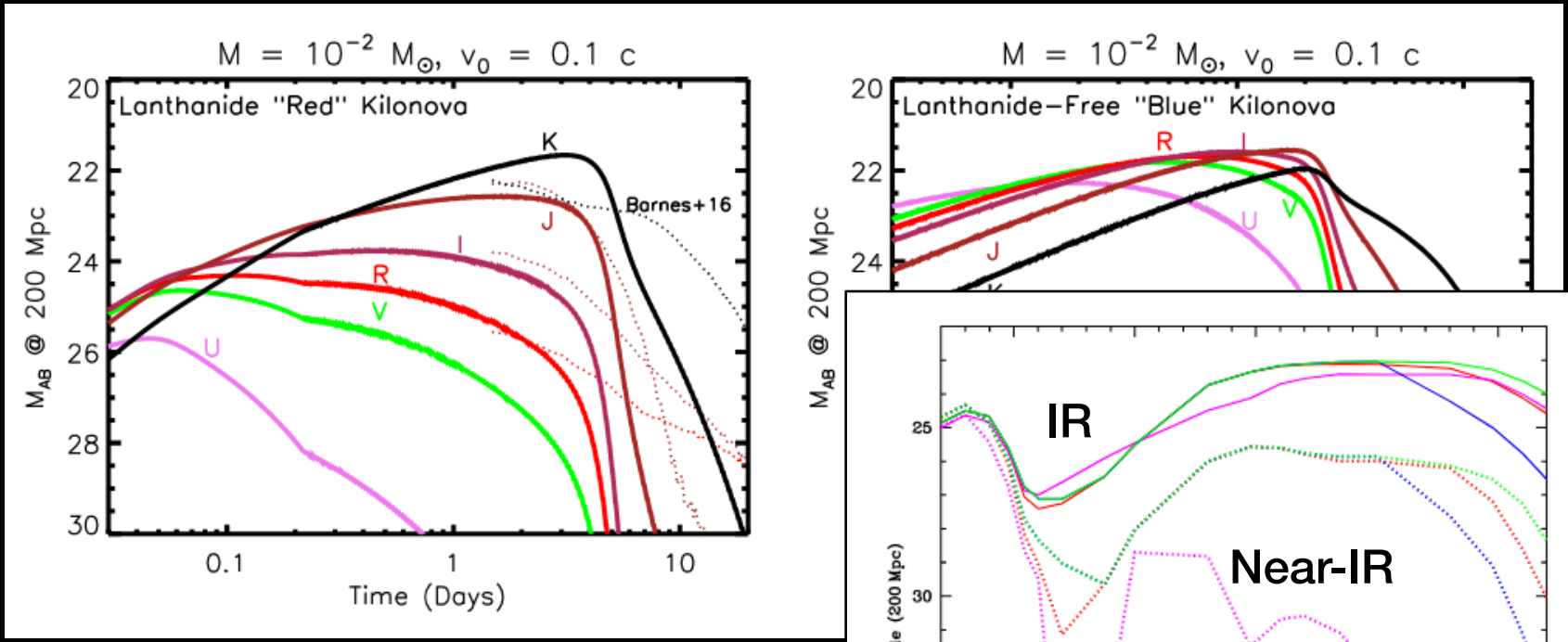
Kasen+ 2017

Kilonova Predictions Uncertain due to Composition



Metzger 2017

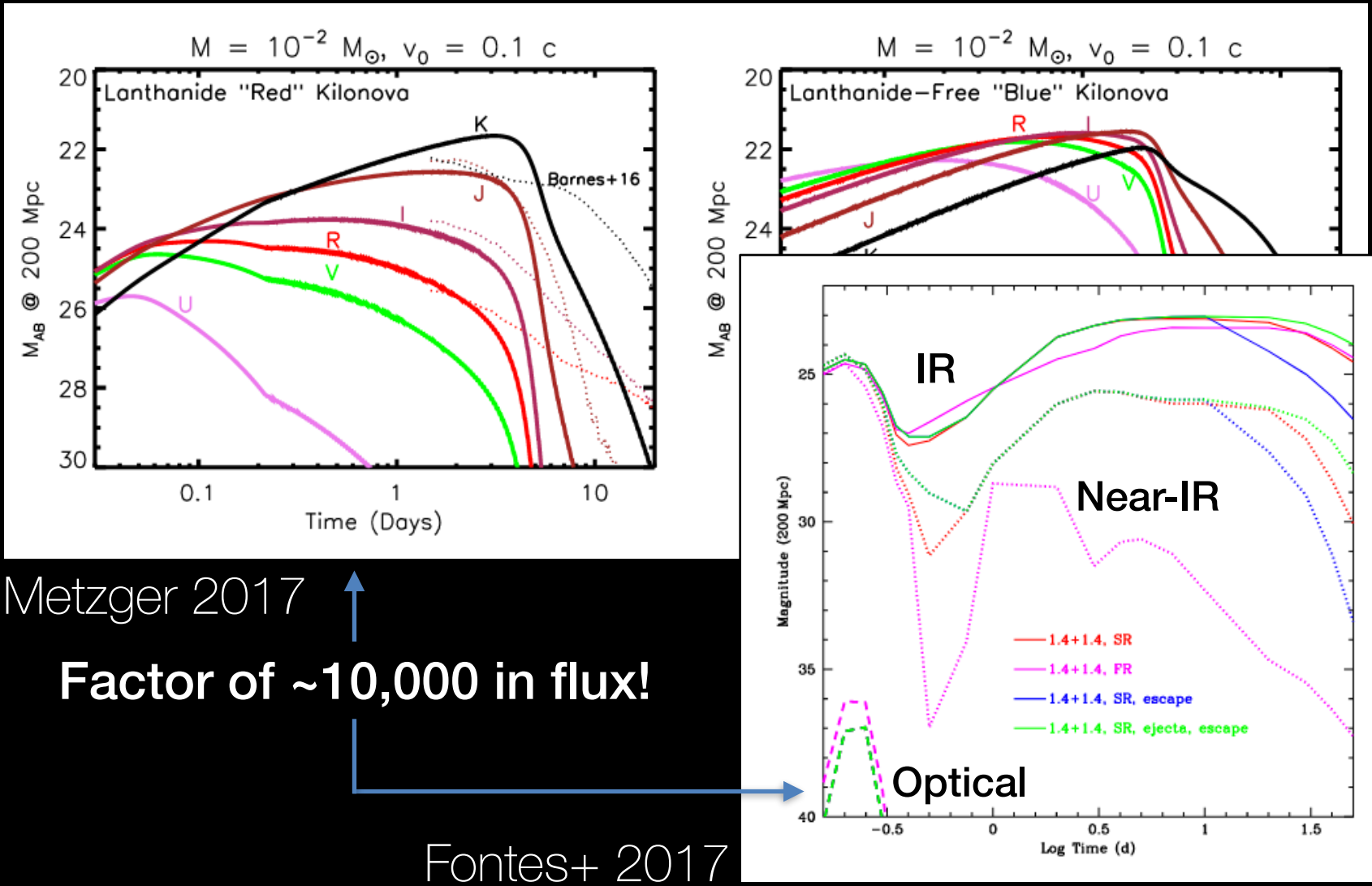
Kilonova Predictions Uncertain due to Composition



Metzger 2017

Fontes+ 2017

Kilonova Predictions Uncertain due to Composition



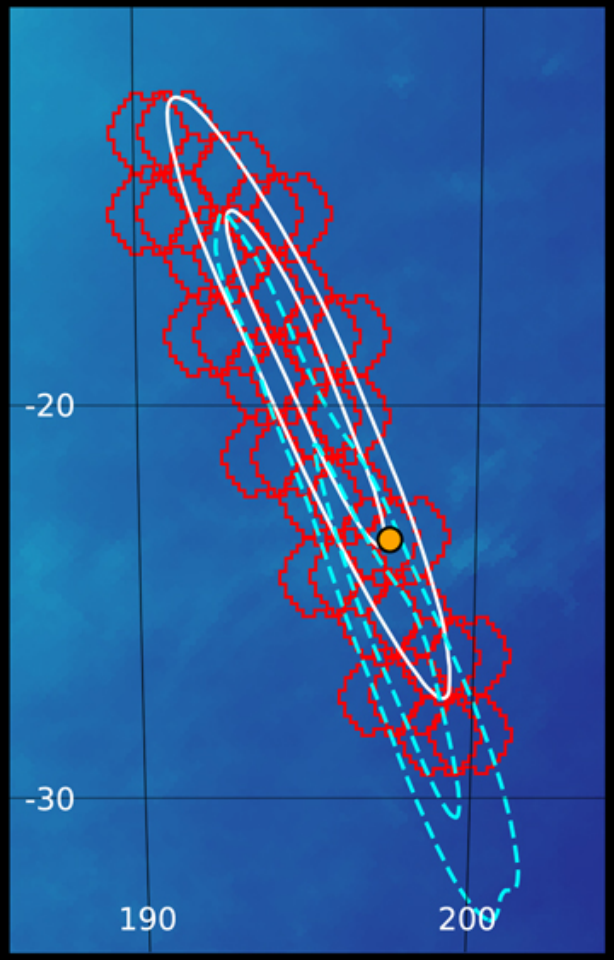
Metzger 2017

Factor of ~10,000 in flux!

Fontes+ 2017

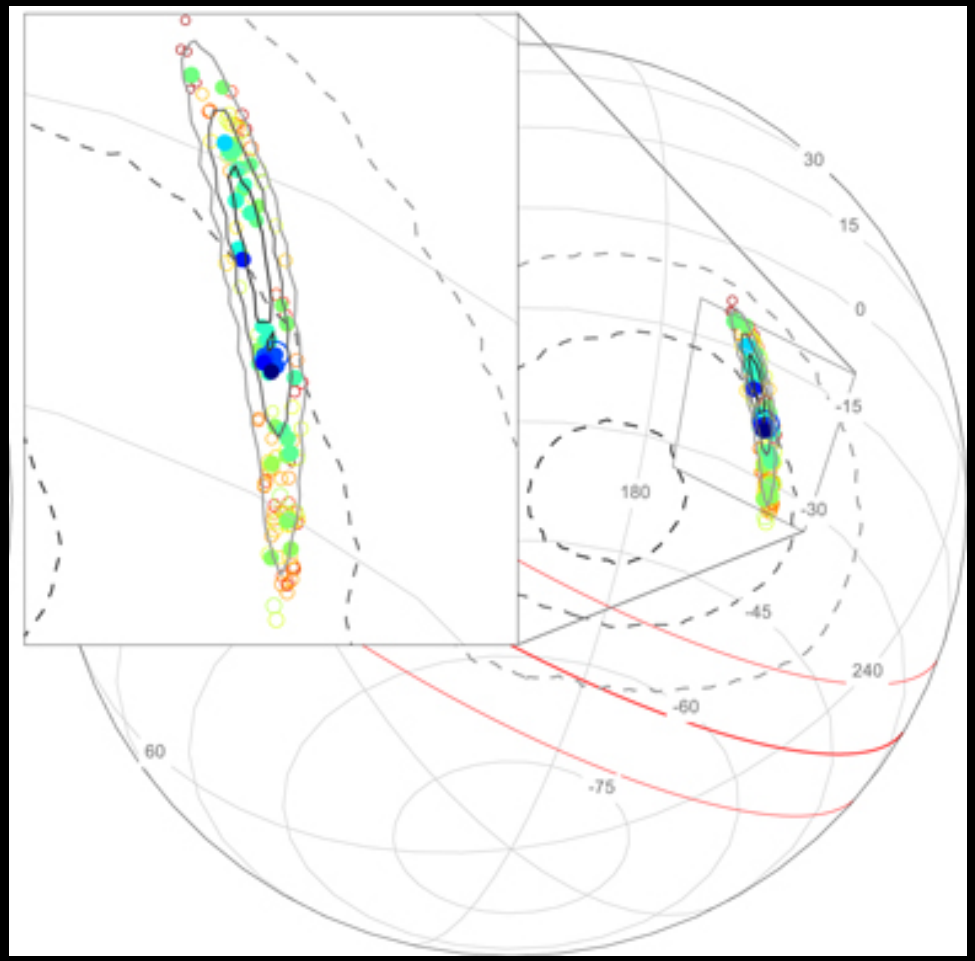
Two Methods for Searching for the EM Counterpart

1. **Tile** the entire region



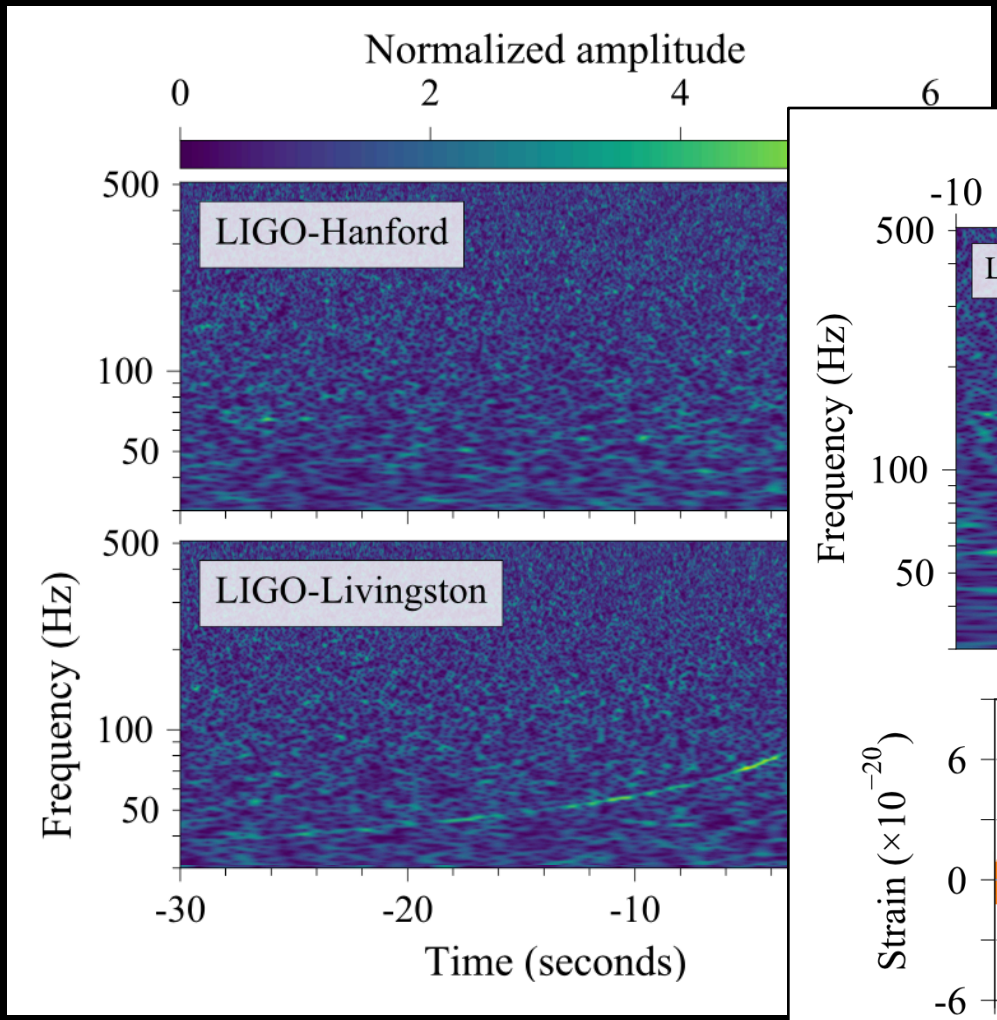
Soares-Santos et al. 2017

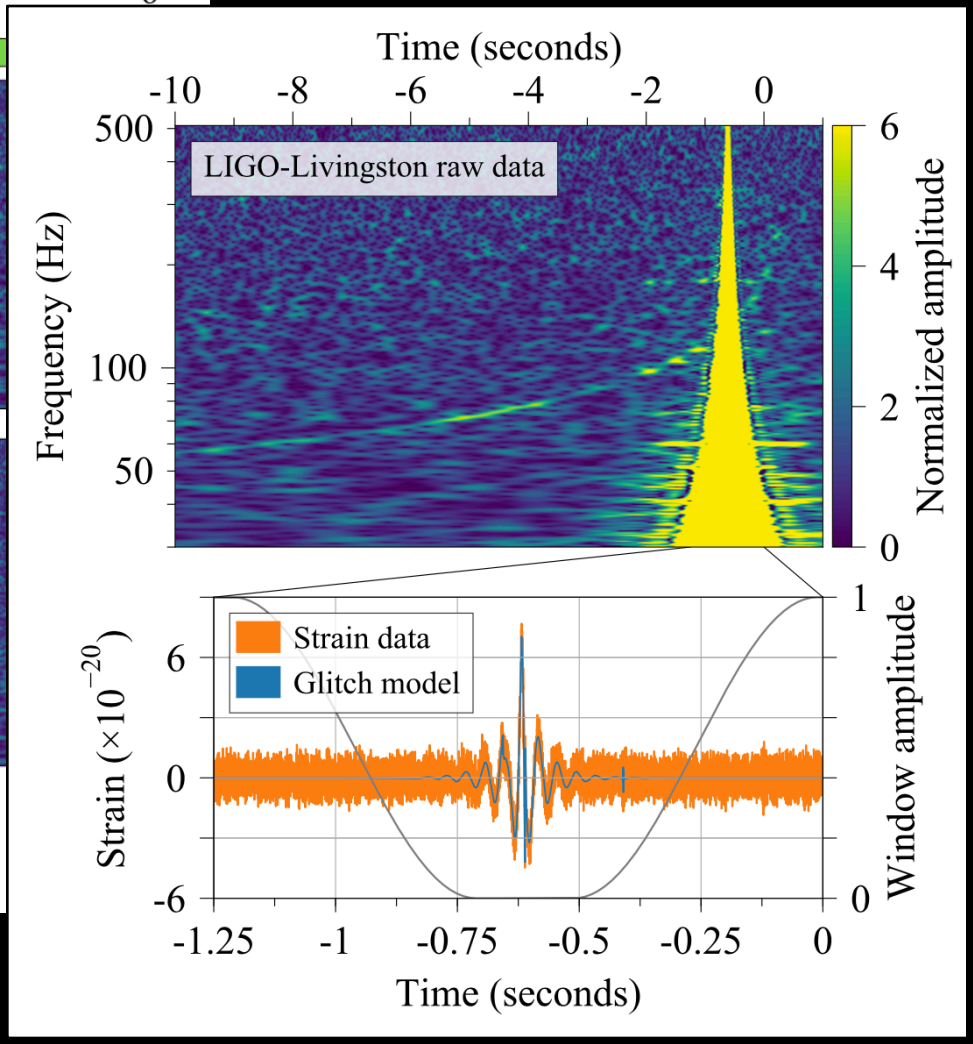
2. Observe specific **galaxies** in the region



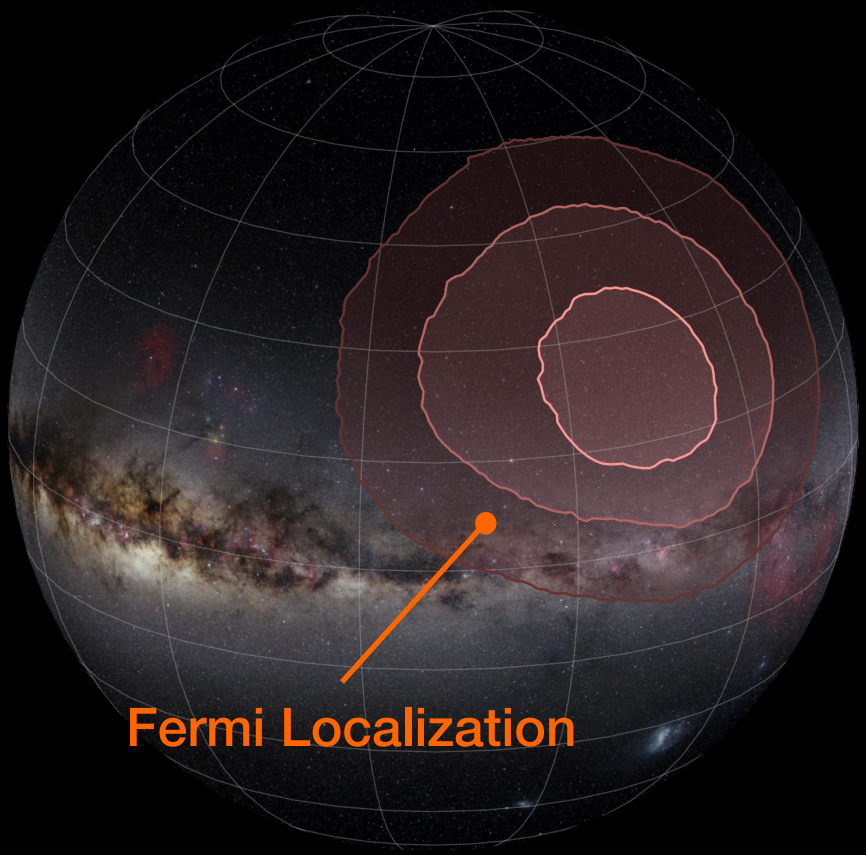
Arcavi et al. 2017

The Trigger on August 17 was a Little Different…





Finding the Kilonova on Aug 17, 2017



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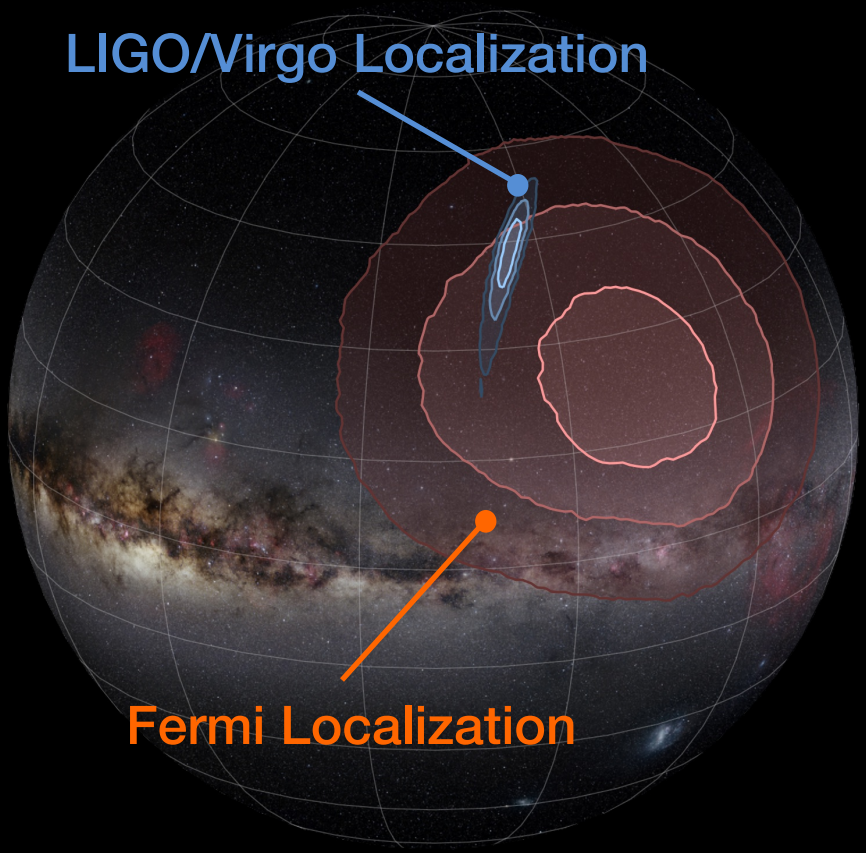
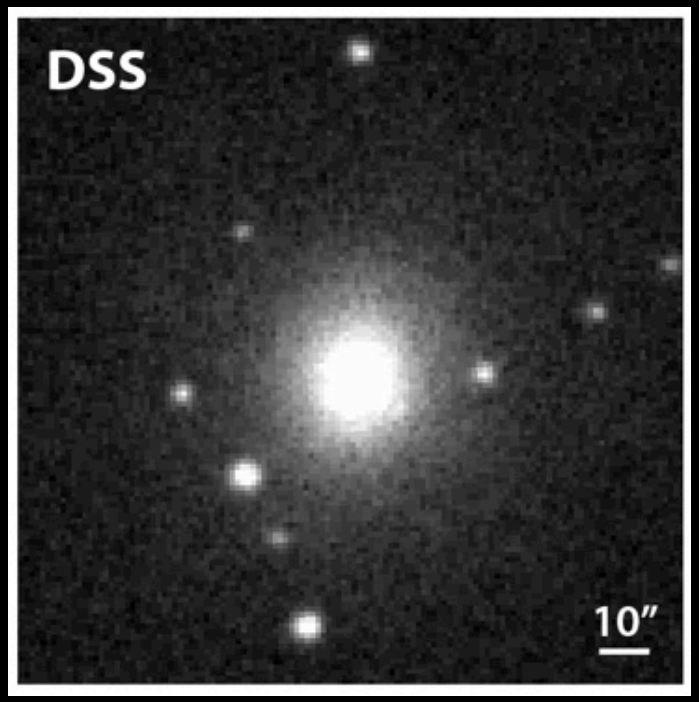
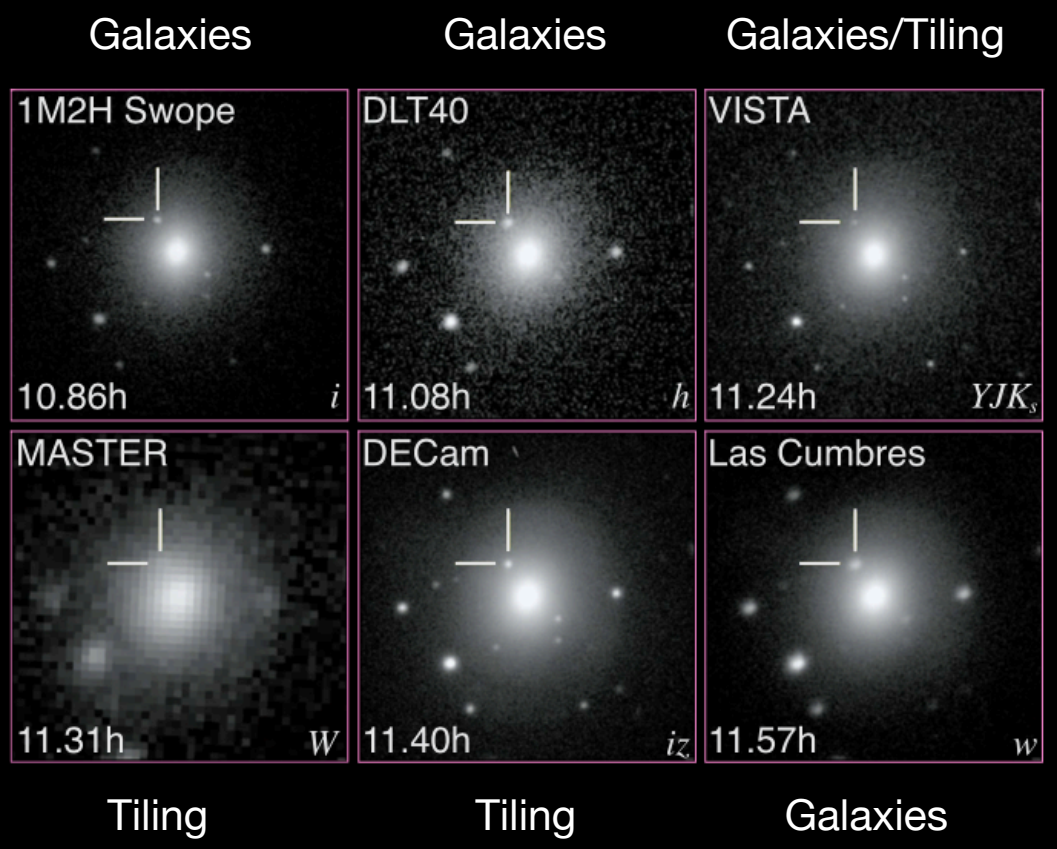


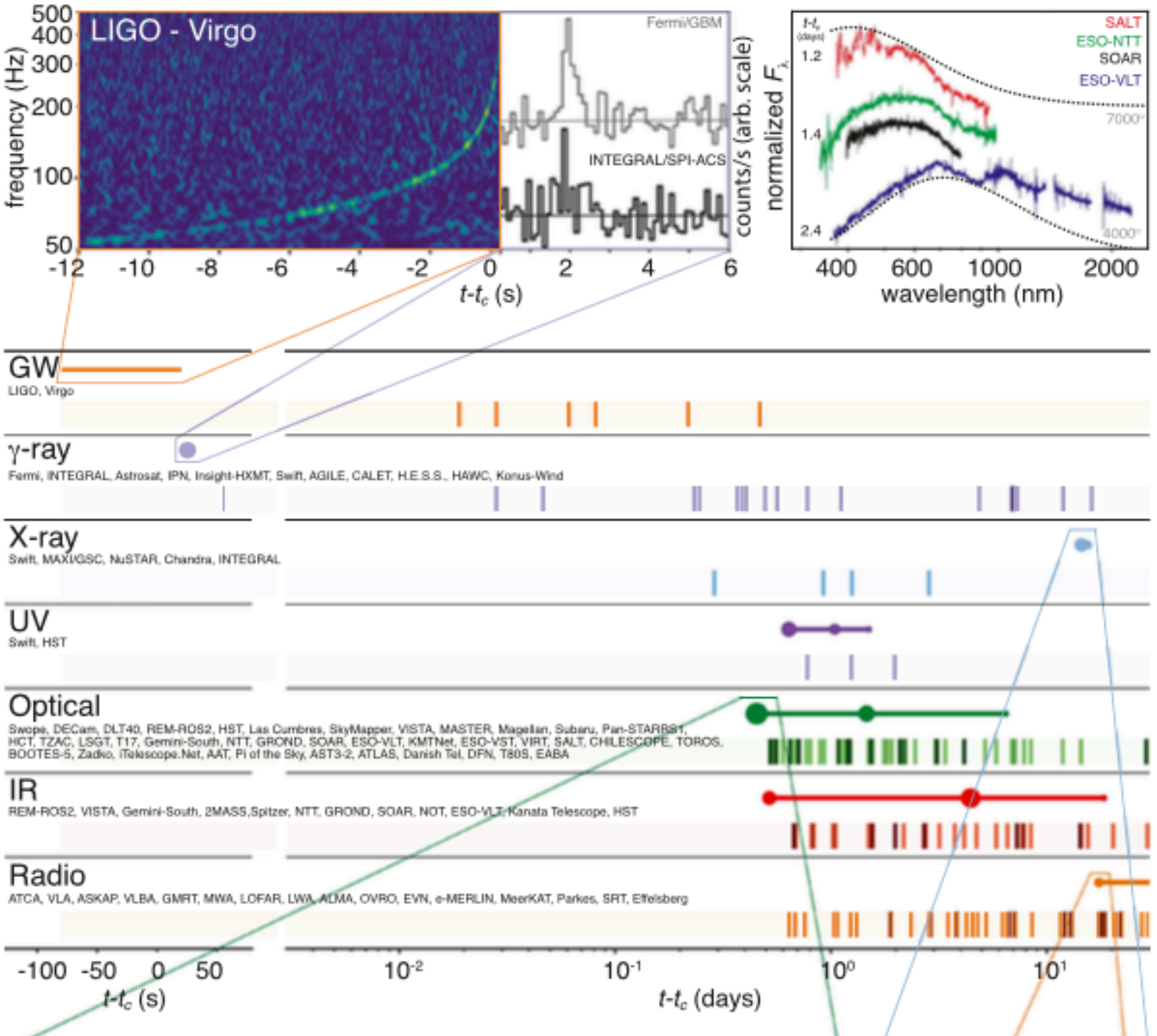




LIGO Collaboration et al. 2017

The unambiguous subtraction of the host galaxy from the optical photometry of the kilonova will be possible only now that the field is visible again.

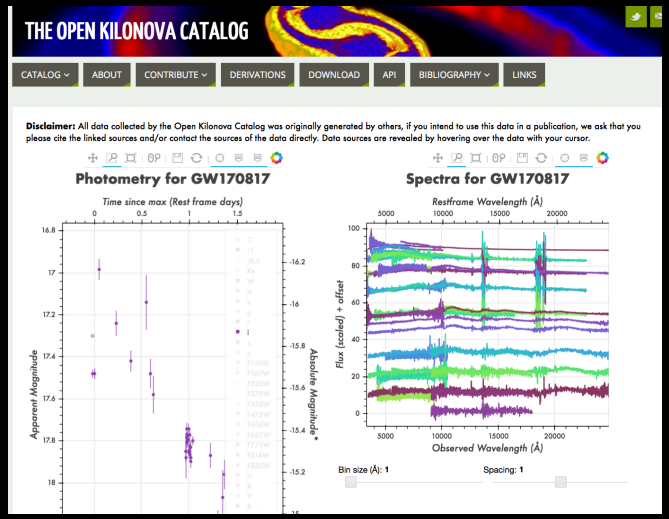

Earth
LIGO Hanford
Virgo
LIGO Livingston



LIGO Collaboration et al. 2017

www.kilonova.space
Data (optical, UV, IR),
Models (MOSFiT)
Guillochon et al. 2017

www.kilonovae.org
Sortable, searchable compilation of all the ~80 papers released on day one.

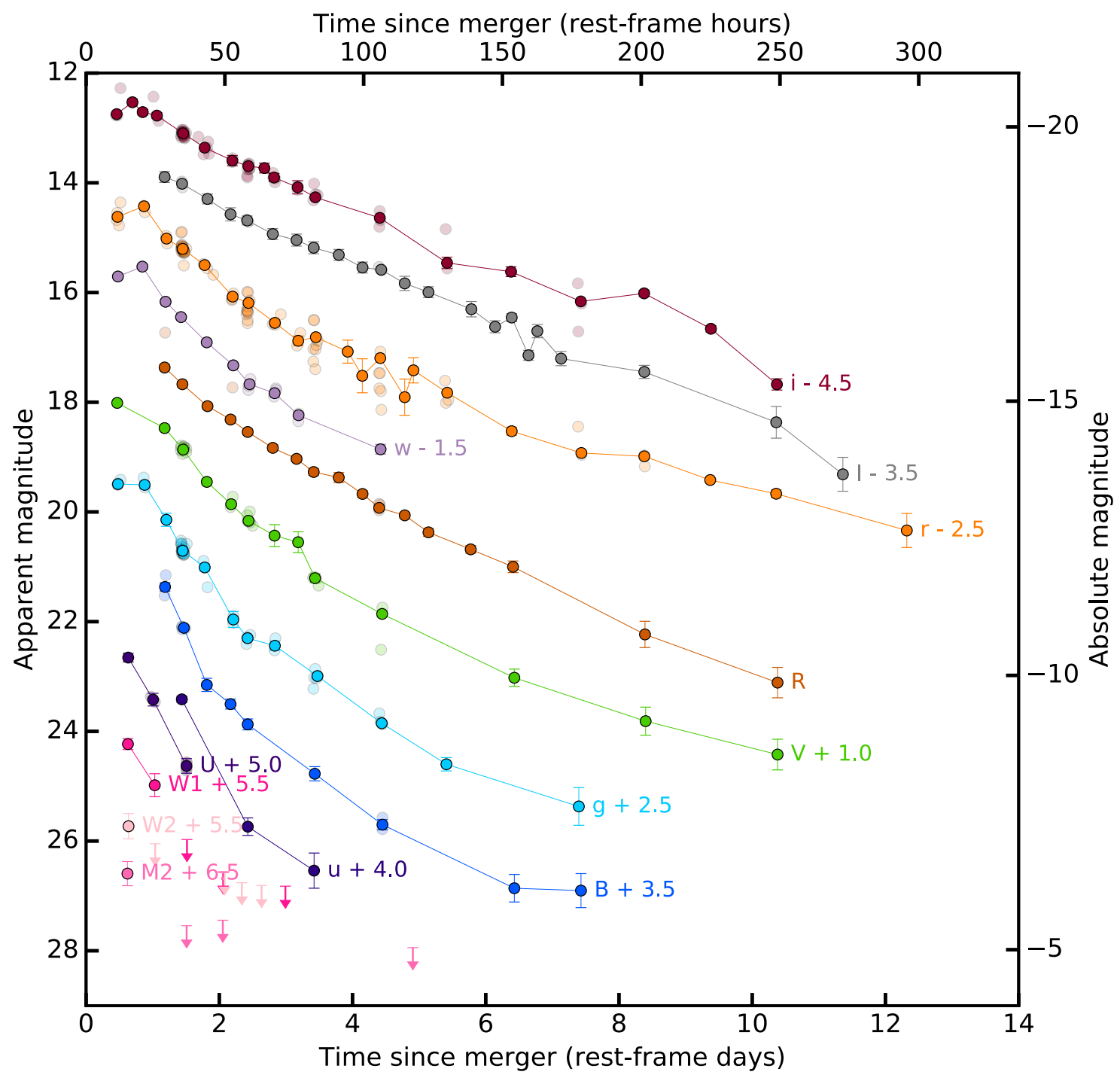


Below is a list of all the papers about GW170817 which came out in the "first wave" on October 16, 2017.
The list was compiled by Maria Drout, Stefano Valenti, and Iair Arcavi. Please let us know if you notice any inaccuracies or omissions.

A compilation of all the GCN circulars related to GW170817 can be found here.

Show 100 entries Search: e.g. optical, theory, Ap.

First Author	Title	Journal	Keywords	Groups	arXiv
Alexander, K.D.	The Electromagnetic Counterpart of the Binary Neutron Star Merger LIGO/Virgo GW170817. VI. Radio Constraints on a Relativistic Jet and Predictions for Late-time Emission from the Kilonova Ejecta	ApJL	radio	DES-GW	1710.05457
Andreoni, I.	Follow up of GW170817 and its electromagnetic counterpart by Australian-led observing programs	PASA	optical, infrared, radio, spectra		1710.05846
ANTARES, IceCube, Pierre Auger, LIGO, Virgo	Search for High-energy Neutrinos from Binary Neutron Star Merger GW170817 with ANTARES, IceCube, and the Pierre Auger Observatory	ApJL, submitted	neutrinos	ANTARES, IceCube, Pierre Auger, LIGO, Virgo	1710.05839
Arcavi, I.	Optical Follow-Up of Gravitational Wave Events with Las Cumbres Observatory	ApJL	optical	Las Cumbres	1710.05842
Arcavi, I.	Optical emission from a kilonova following a gravitational-wave-detected neutron-star merger	Nature	optical	Las Cumbres	1710.05843
Berger, E.	Focus on the Electromagnetic Counterpart of the Neutron Star Binary Merger GW170817	ApJL	focus issue		
Blanchard, P. K.	The Electromagnetic Counterpart of the Binary Neutron Star Merger LIGO/Virgo GW170817. VII. Properties of the Host Galaxy and Constraints on the Merger Timescale	ApJL	host galaxy	DES-GW	1710.05458



Andreoni et al. 2017,
Arcavi et al. 2017,
Cowperthwaite et al. 2017,
Coulter et al. 2017,
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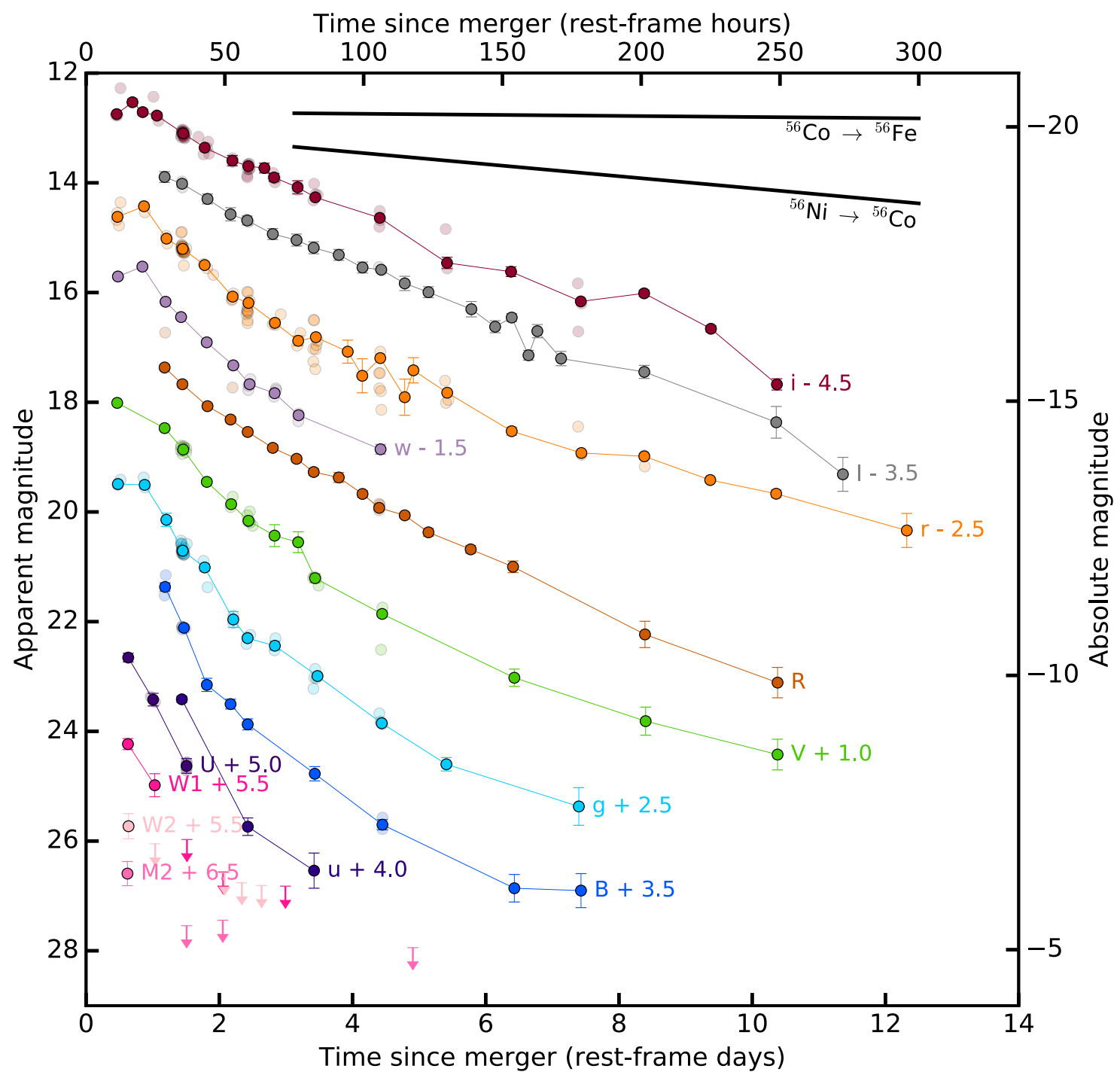
Tanvir et al. 2017,
Troja et al. 2017,
Utsumi et al. 2017,
Valenti et al. 2017.

Retrieved via kilonovae.space



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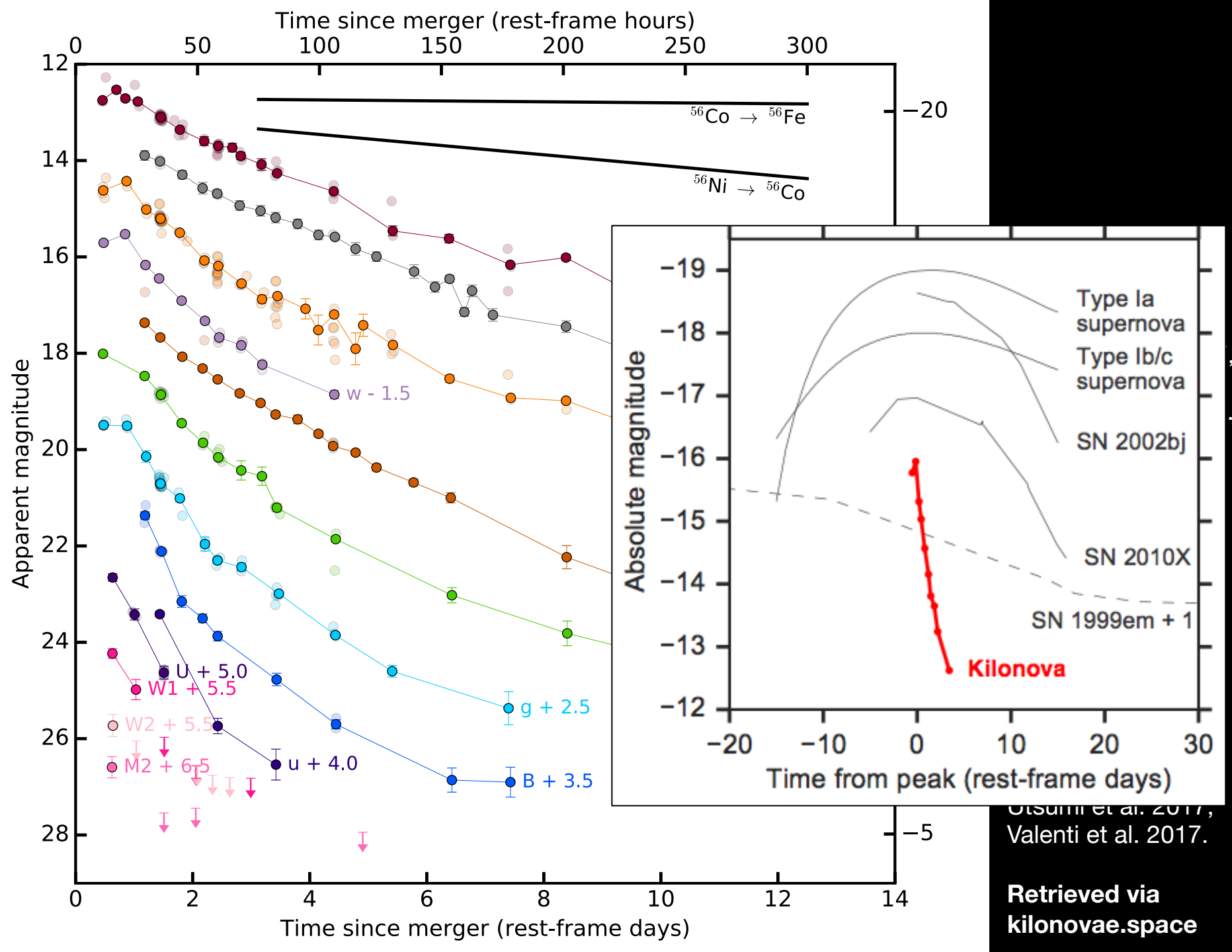

Valenti et al. 2017.

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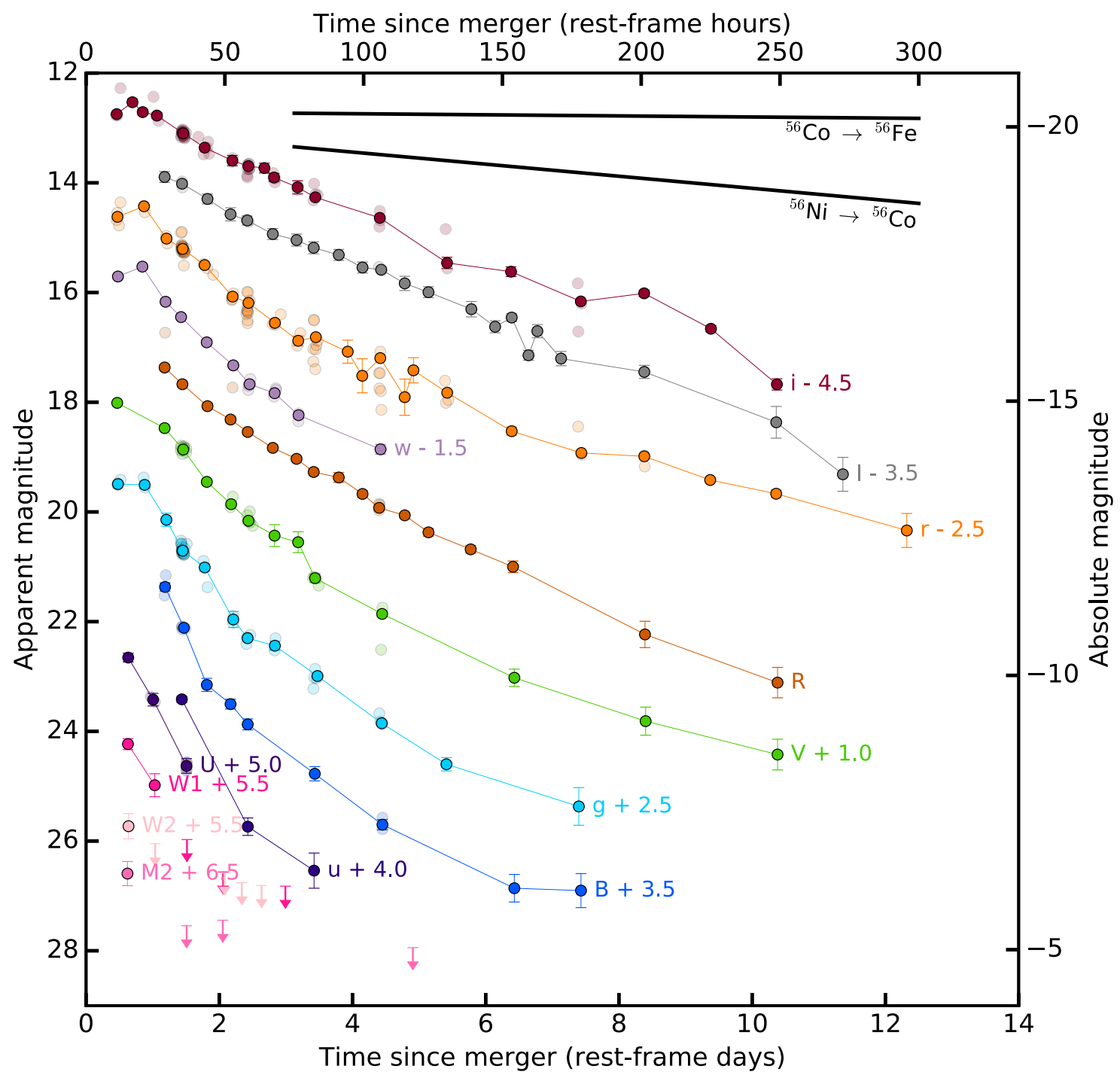

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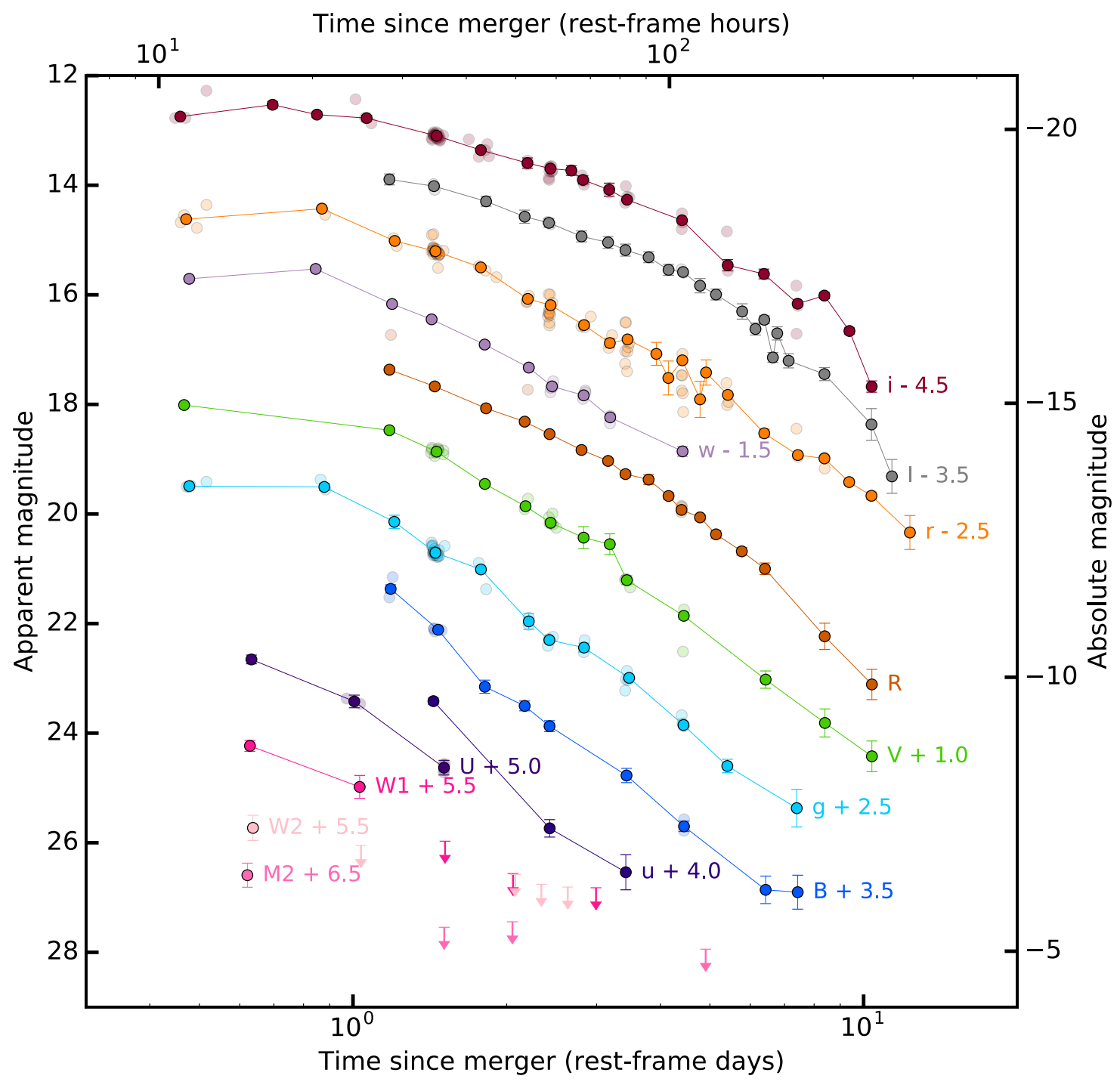

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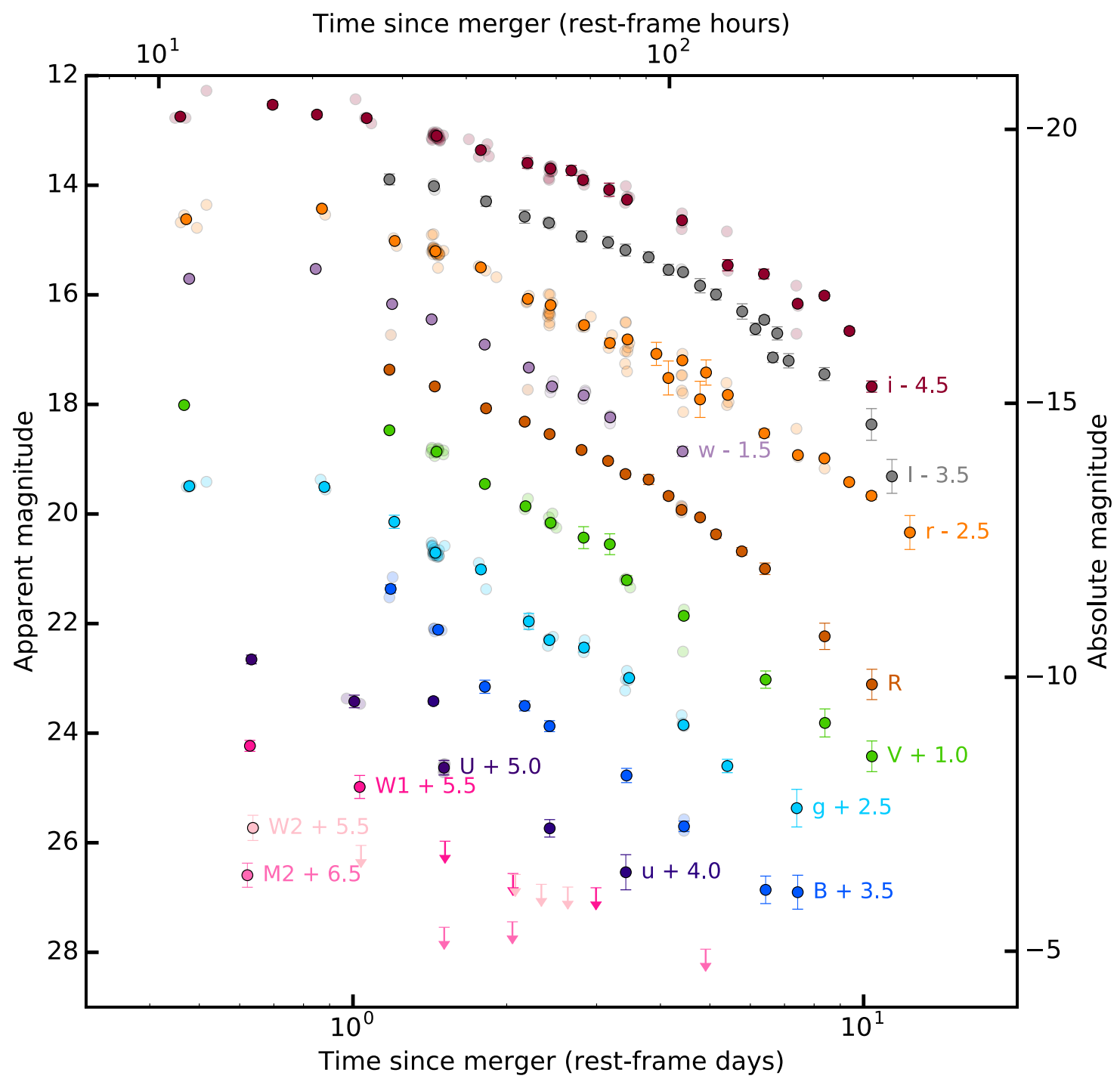

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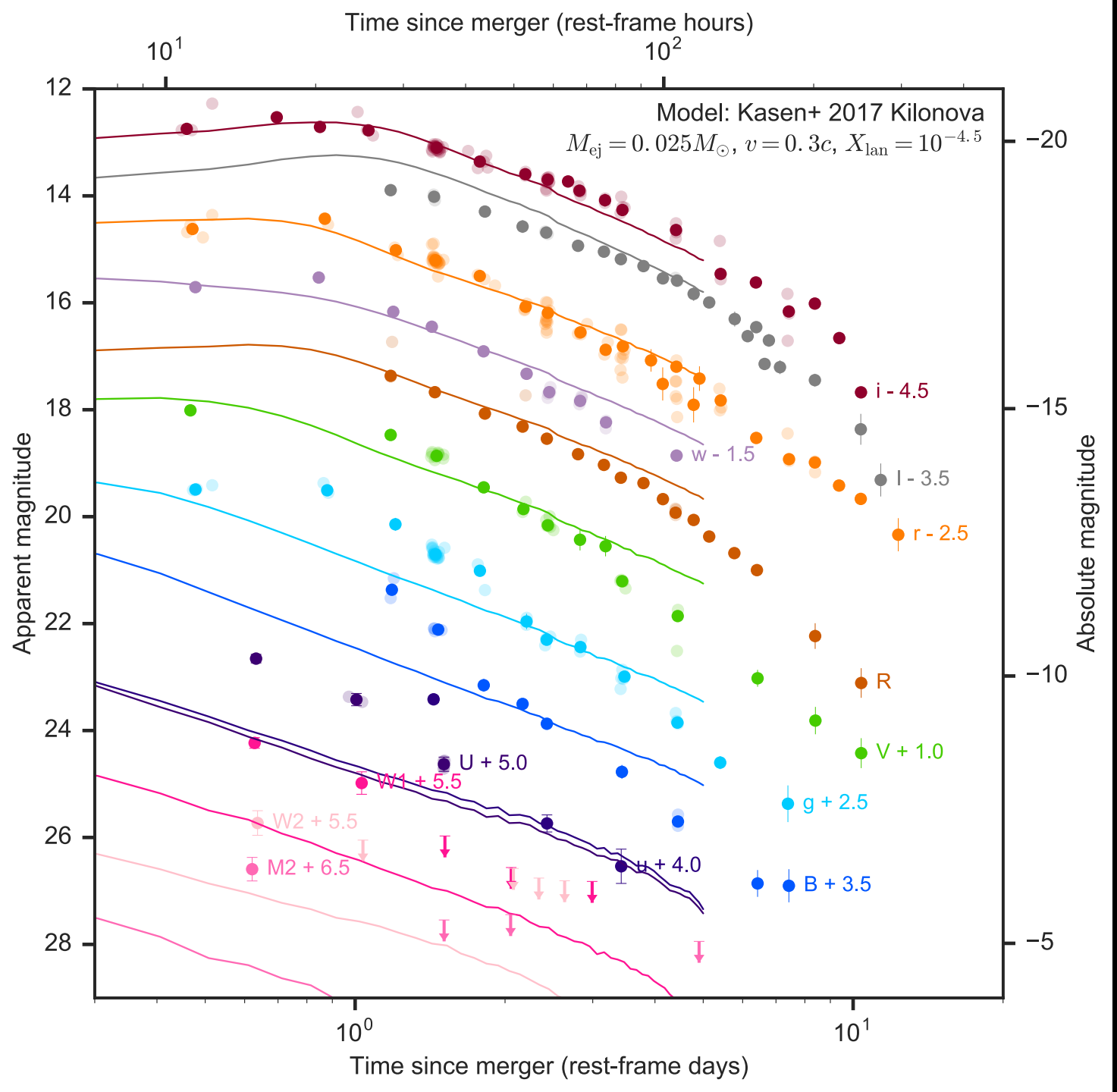

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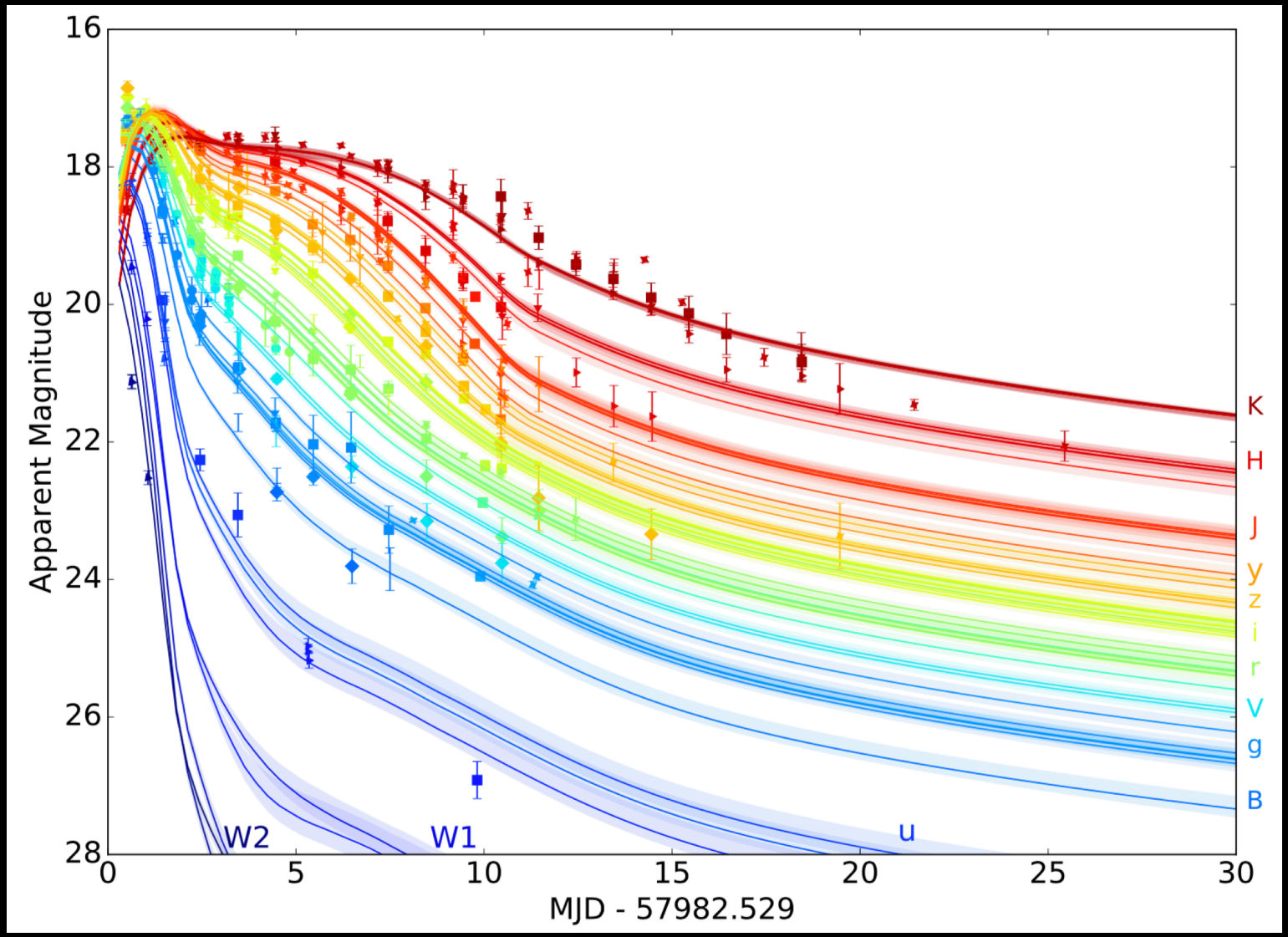
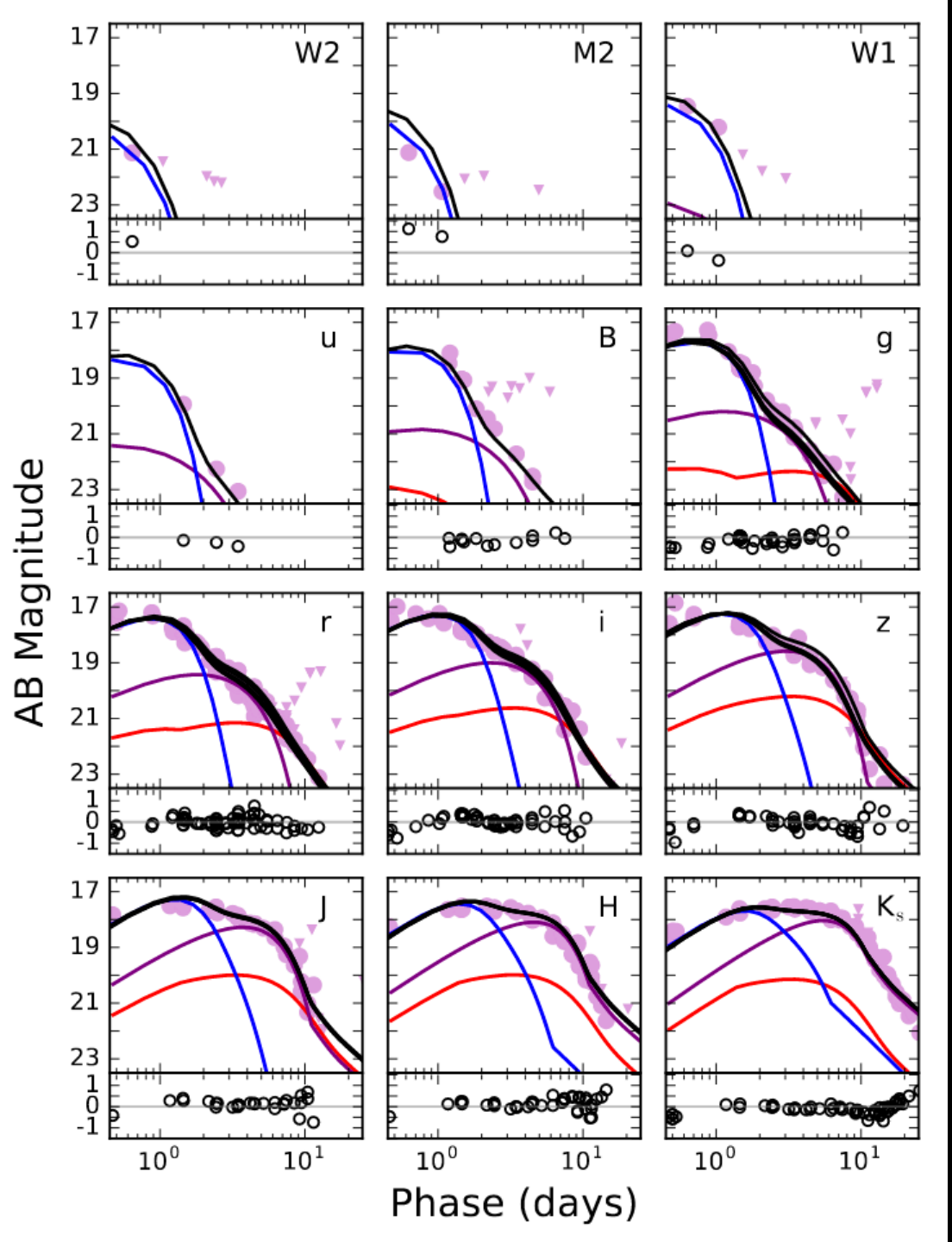
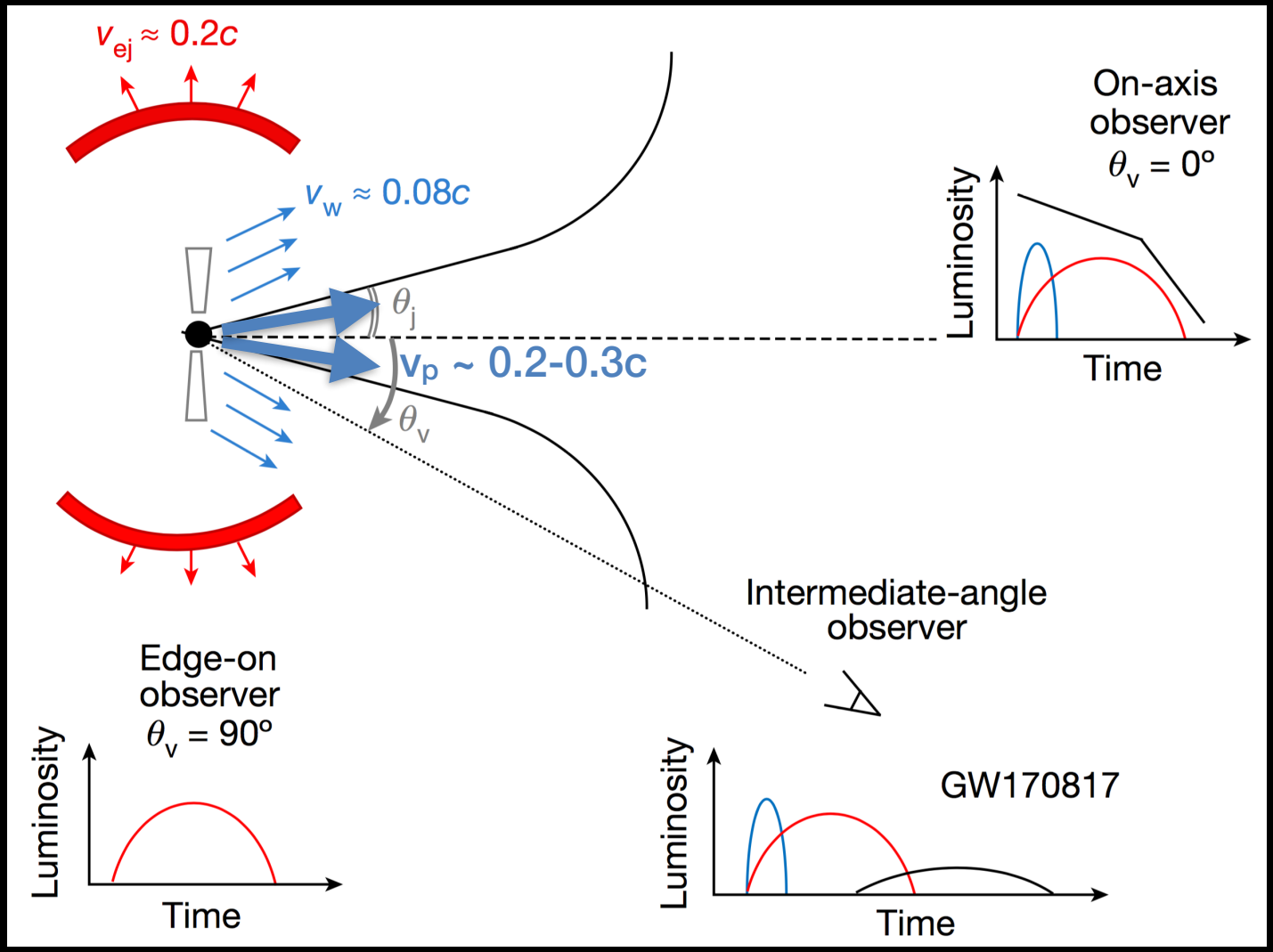


Villar et al. 2017



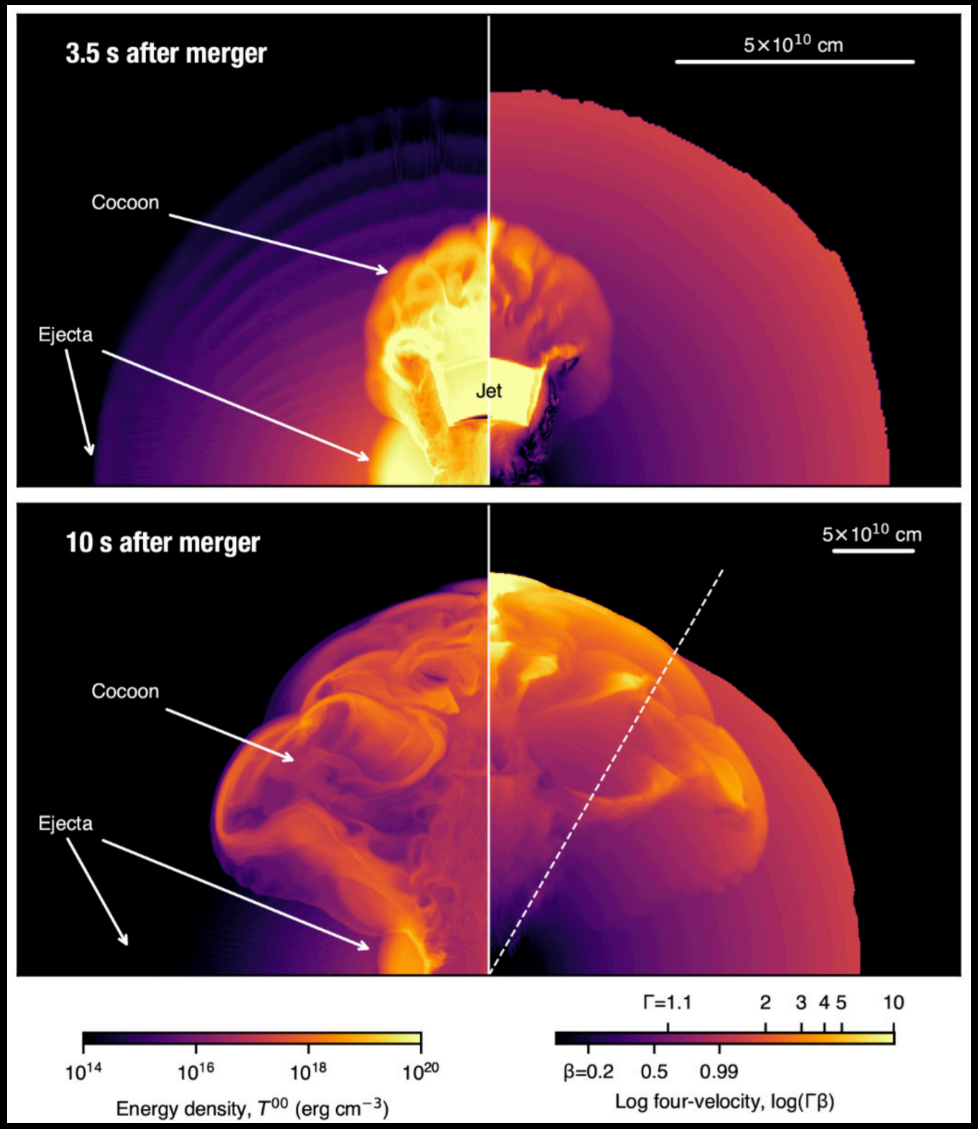
Villar et al. 2017

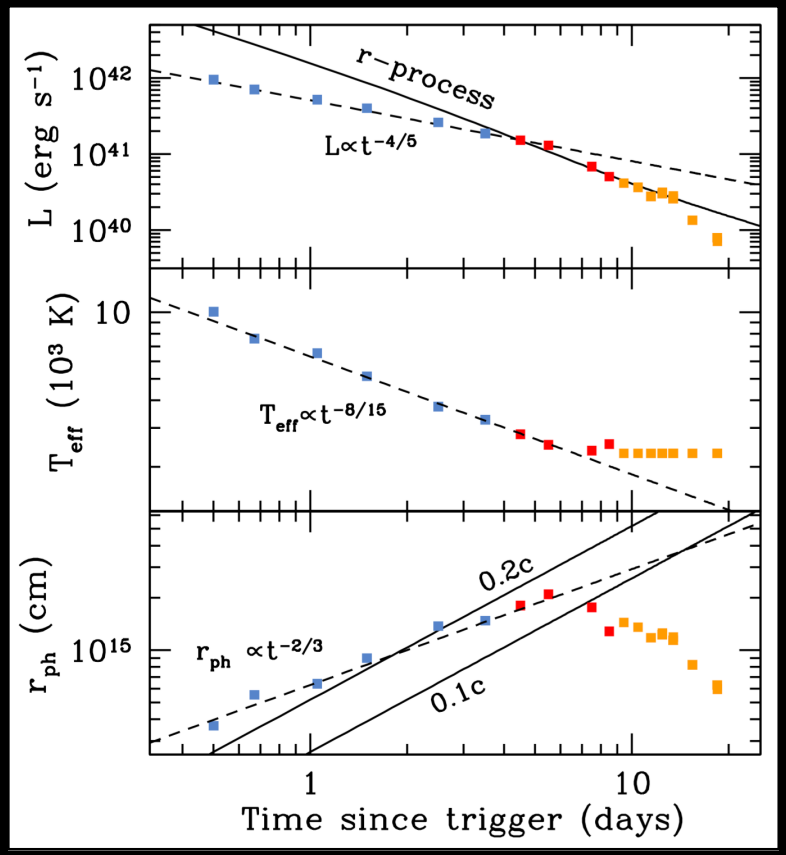
Different Components + Favorable Viewing Angle?



Troja et al. 2017

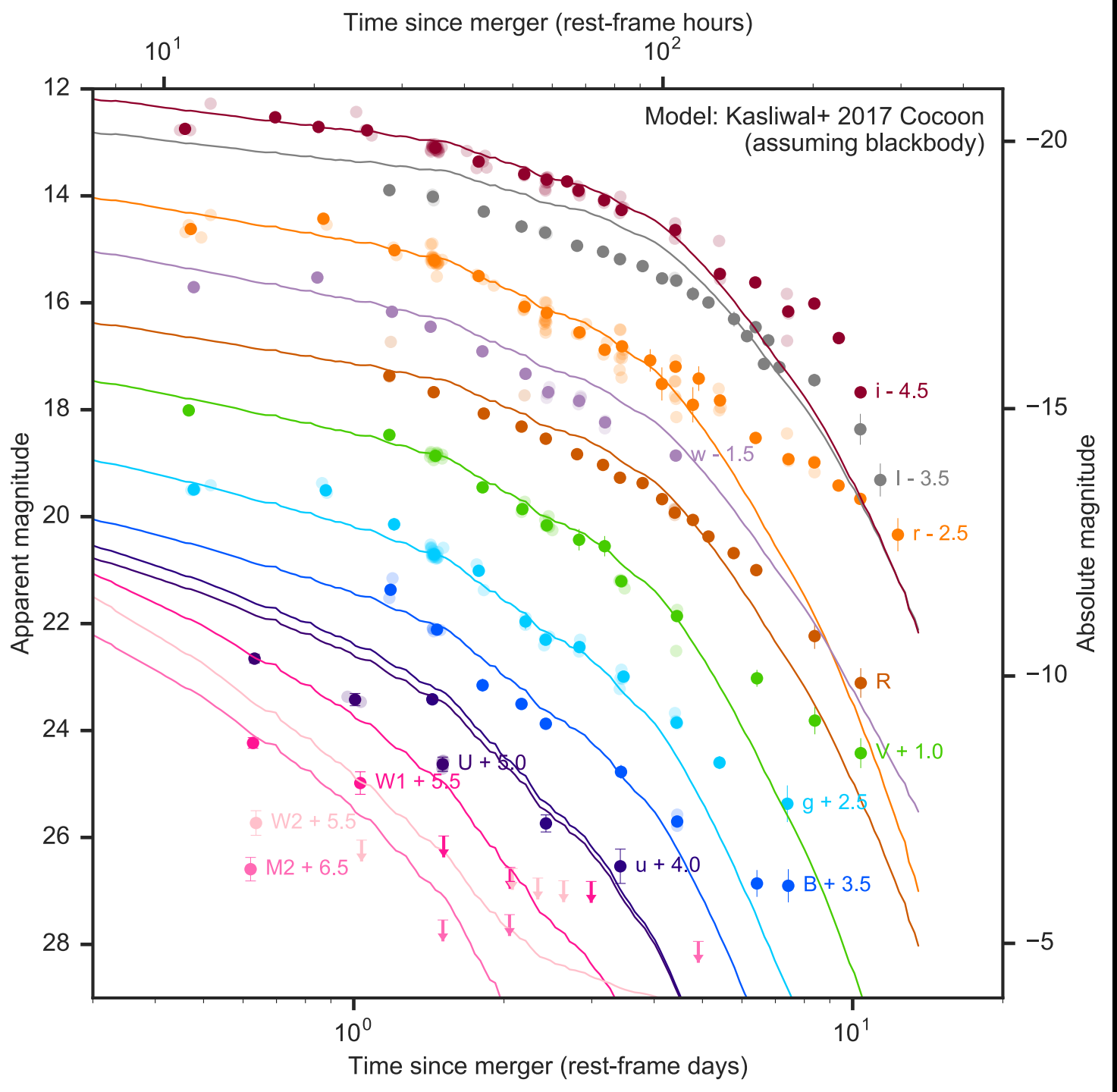
Alternative: Jet was not Launched, Made Cocoon





Kasliwal+ 2017

see also Piro & Kollmeier 2017, Nakar & Piran 2017, Gottlieb+ 2017



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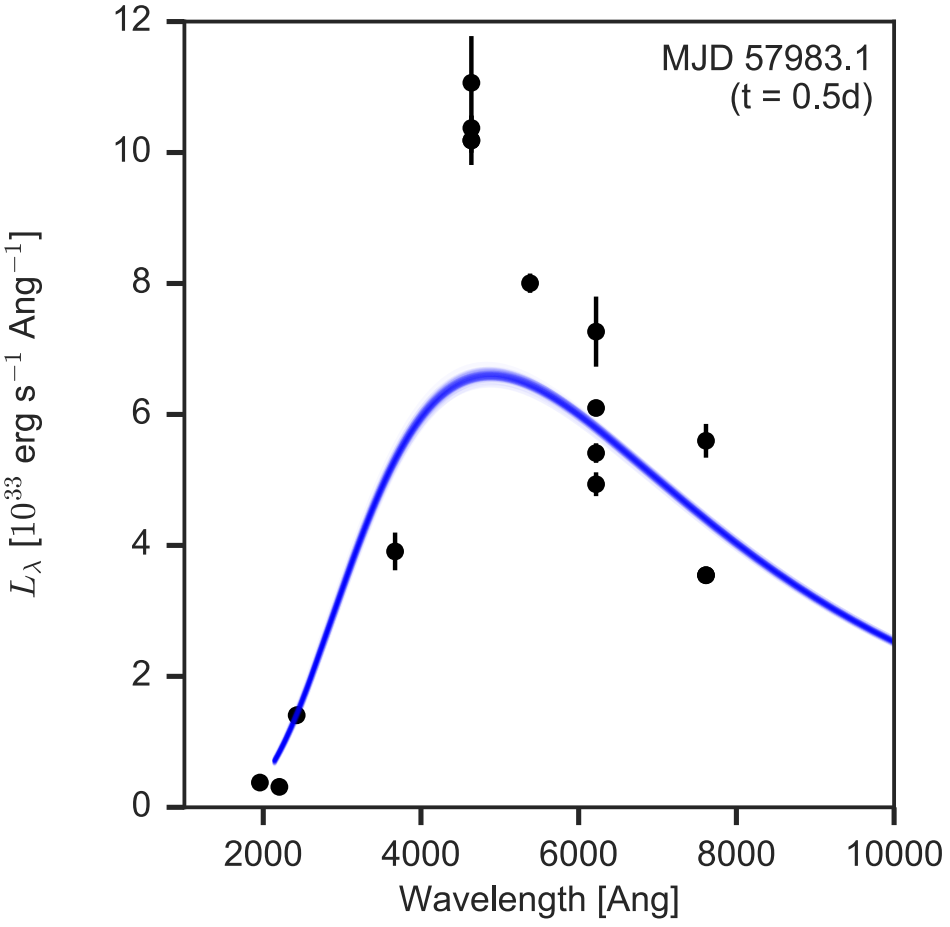
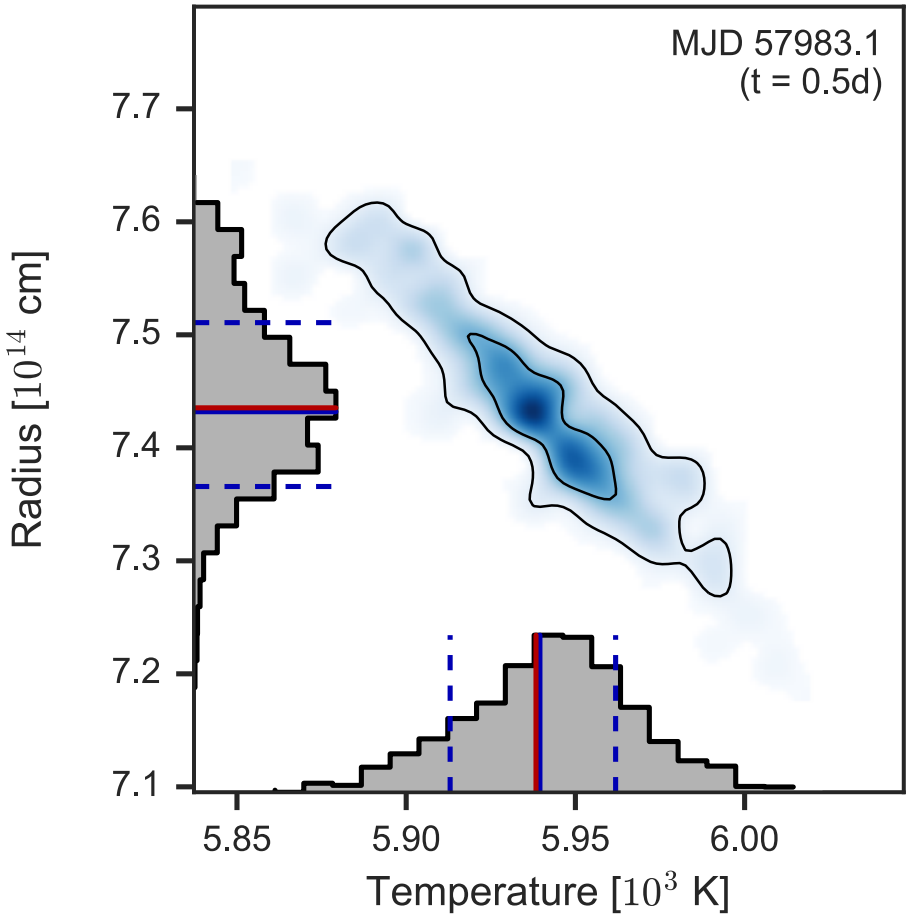
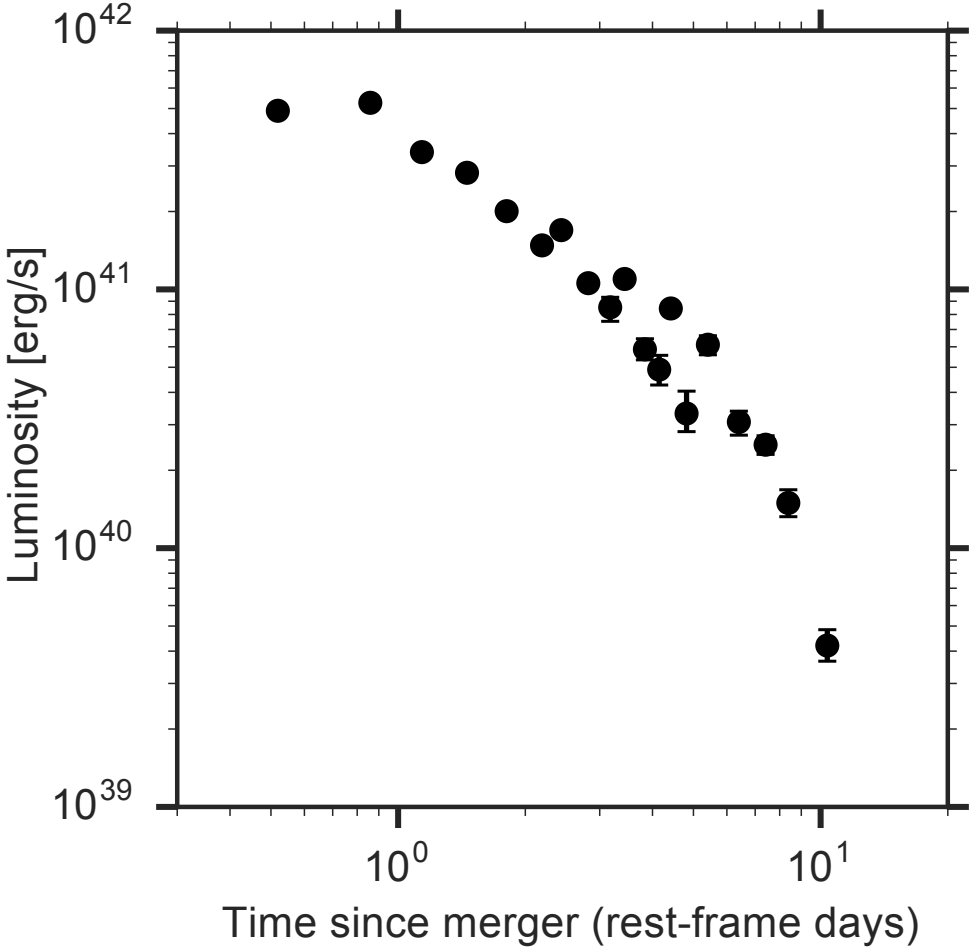
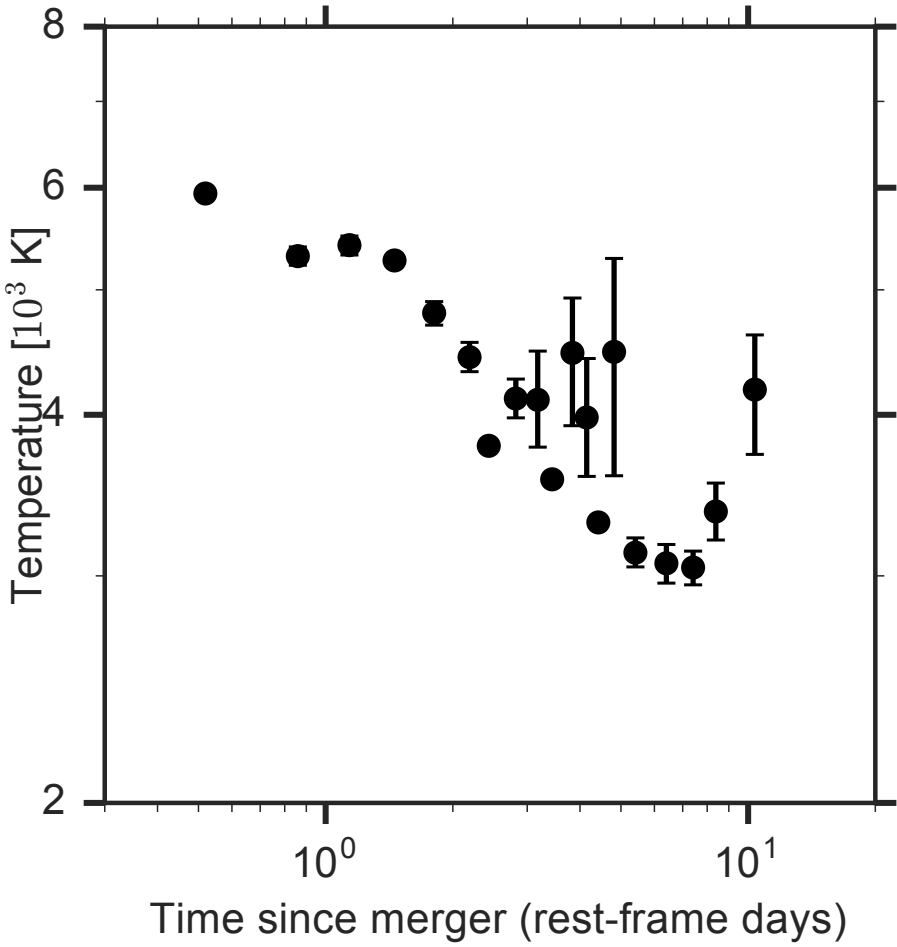
Emission Not a Blackbody (at Early Times)





But if Assume a Blackbody…





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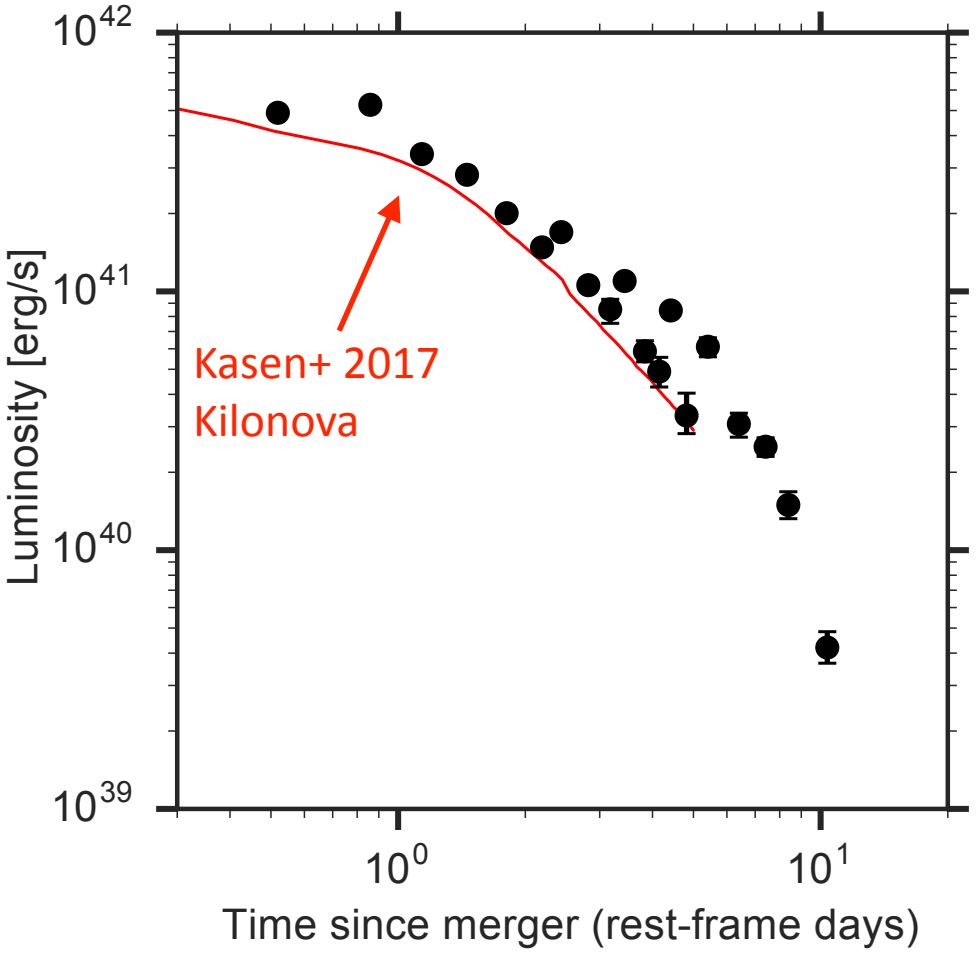

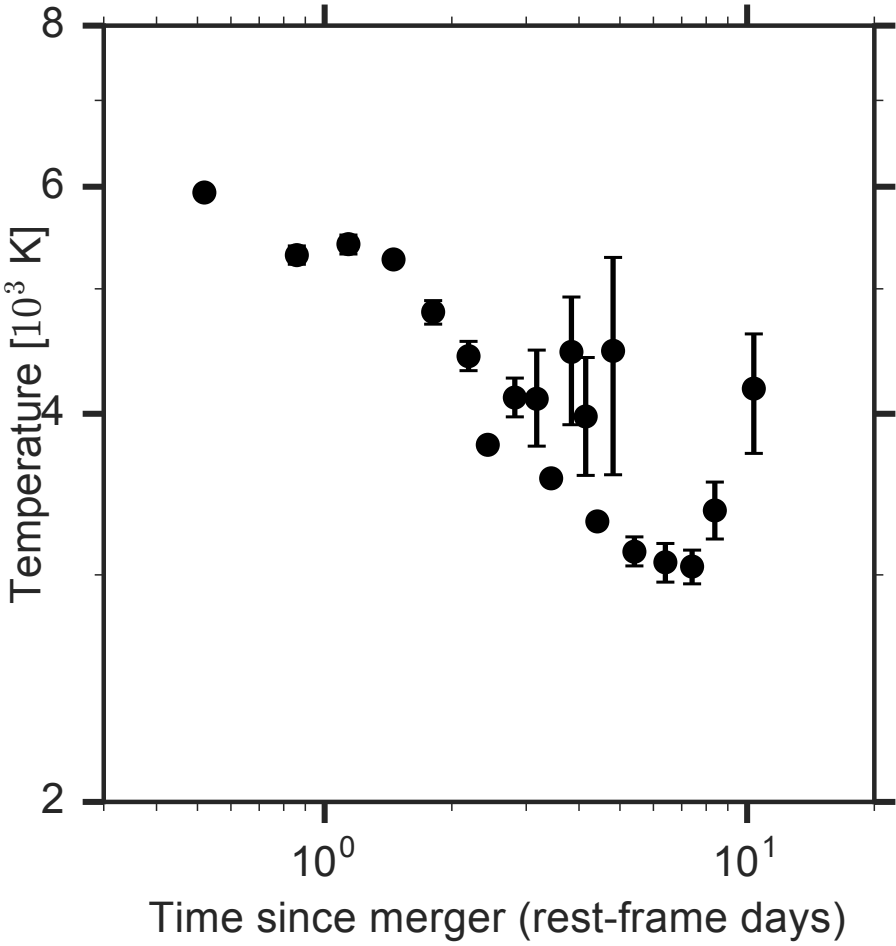

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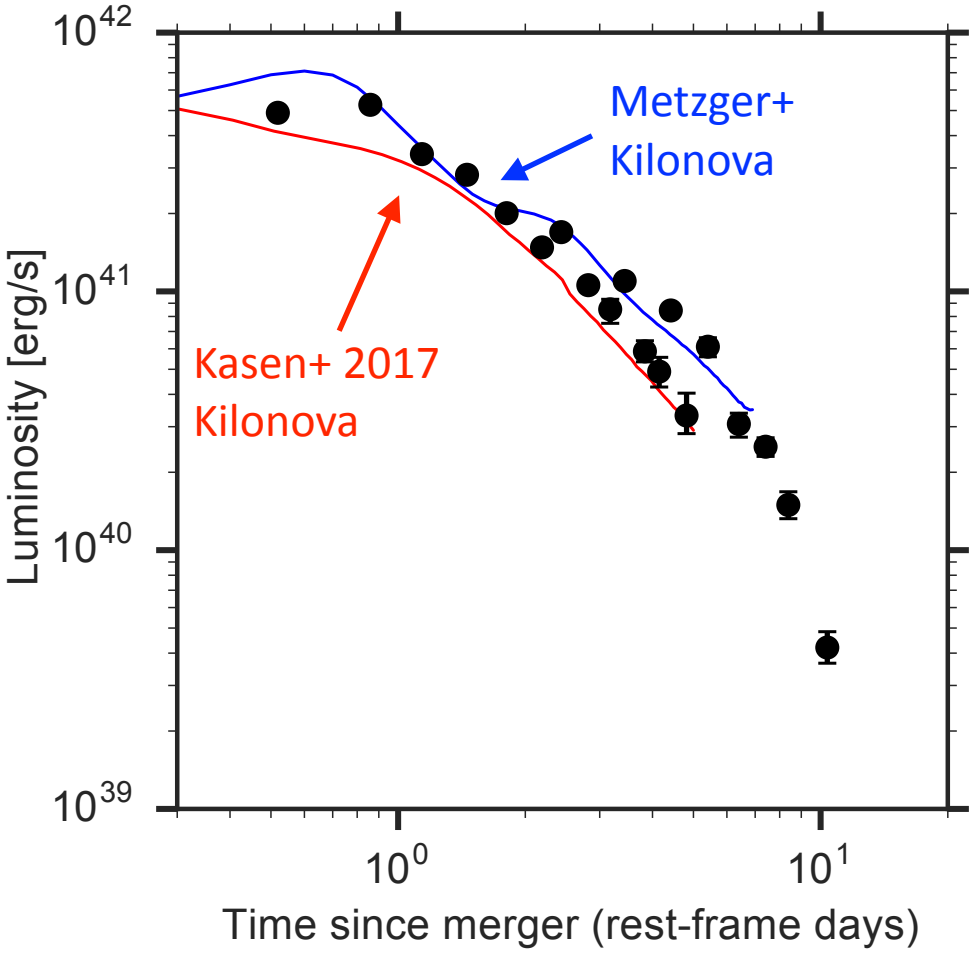

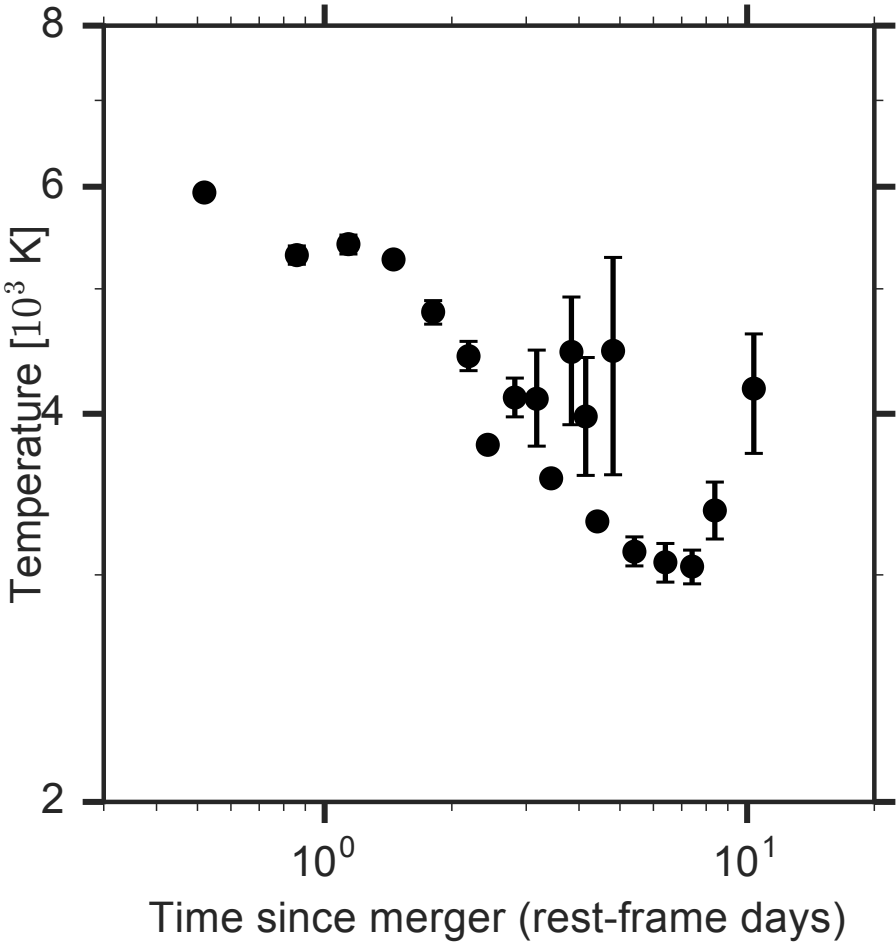

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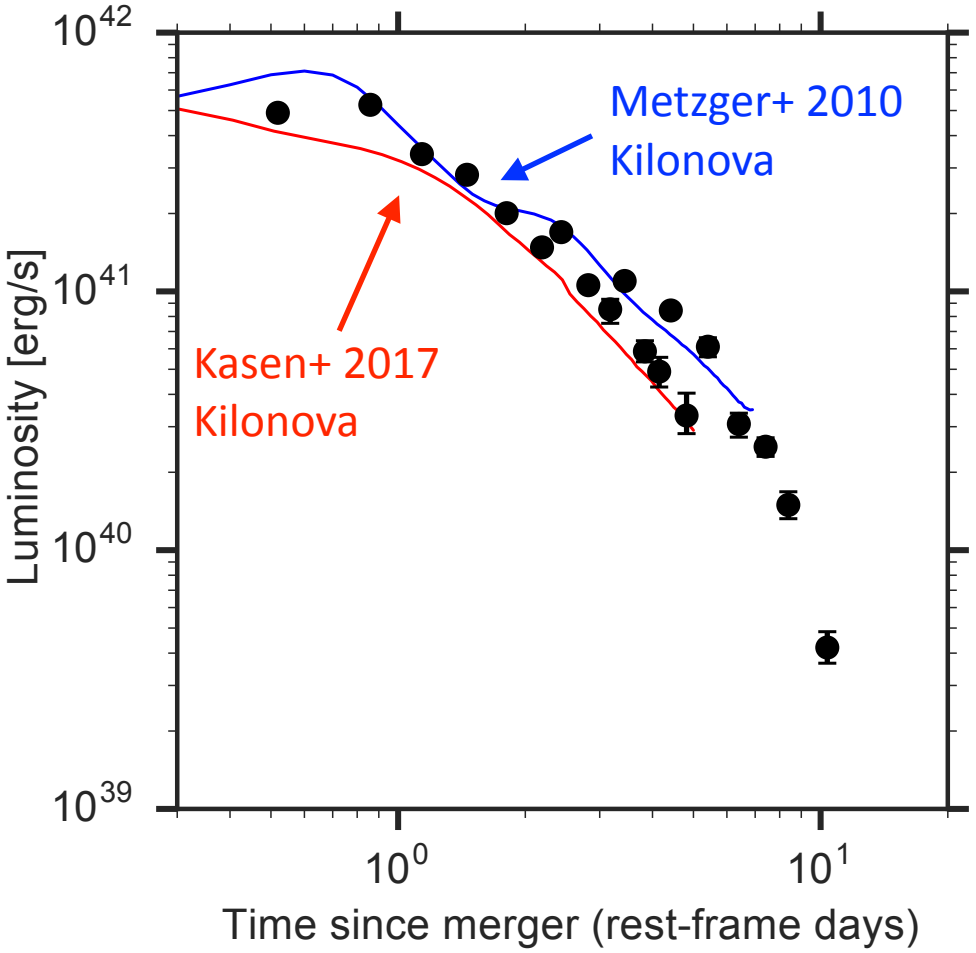

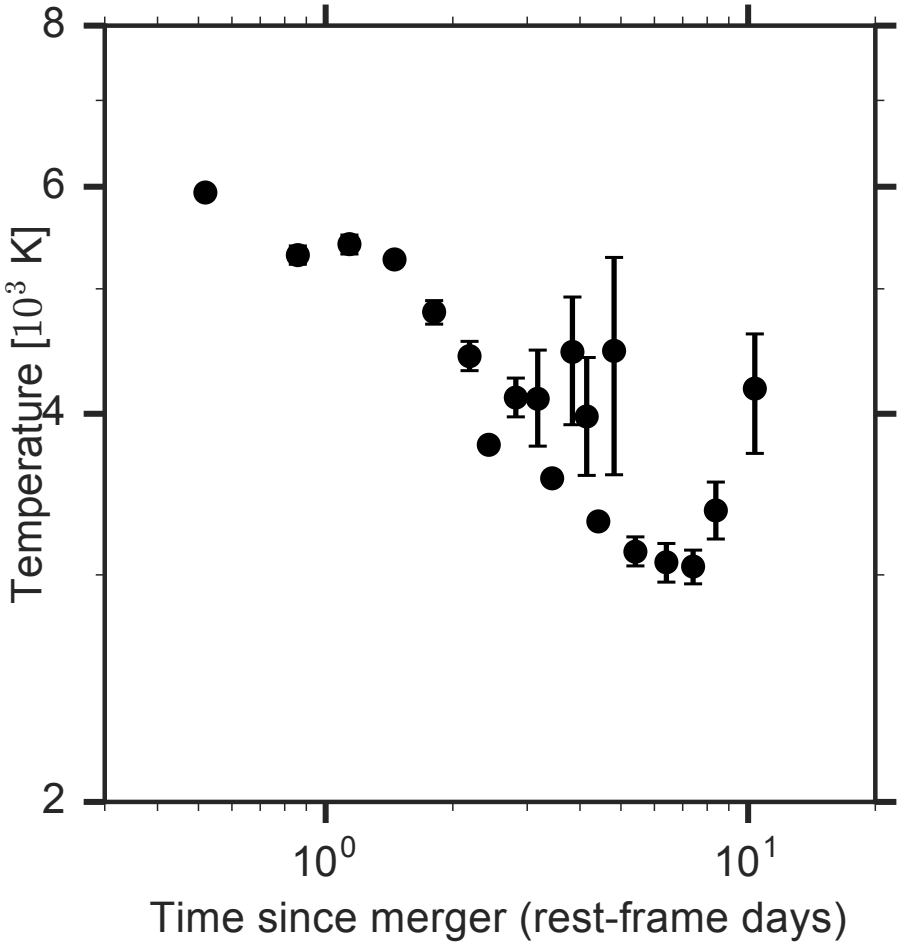

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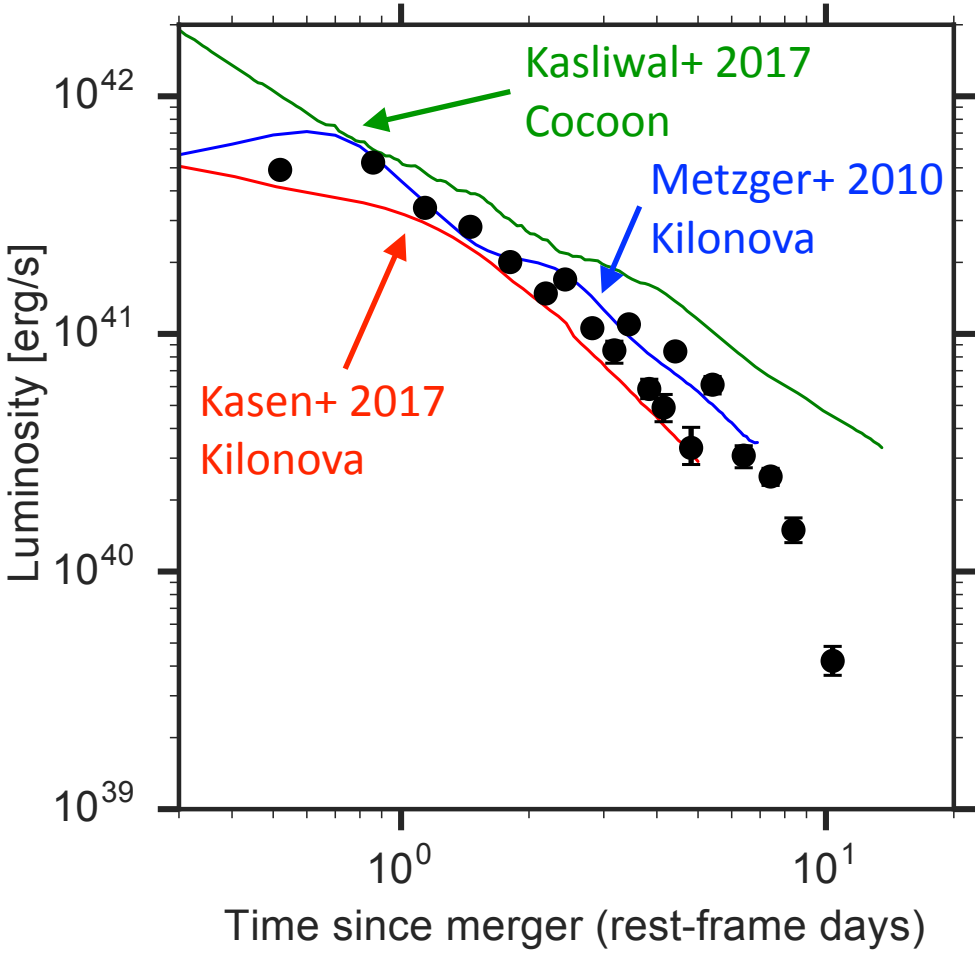
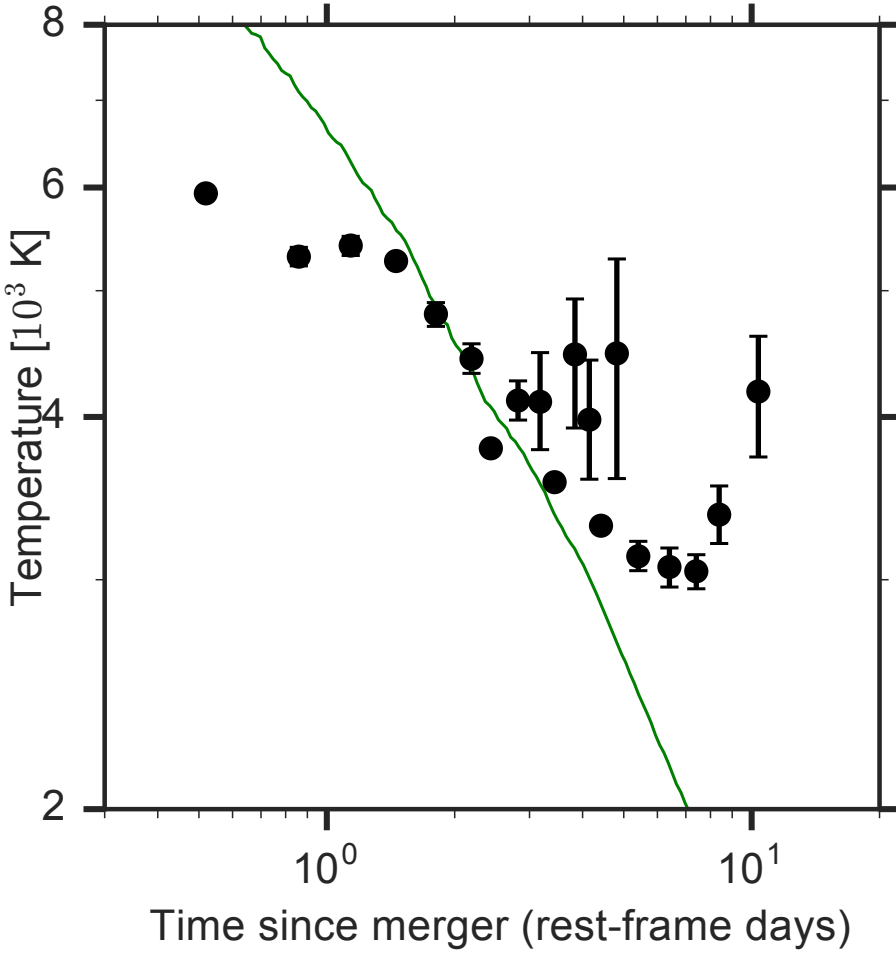
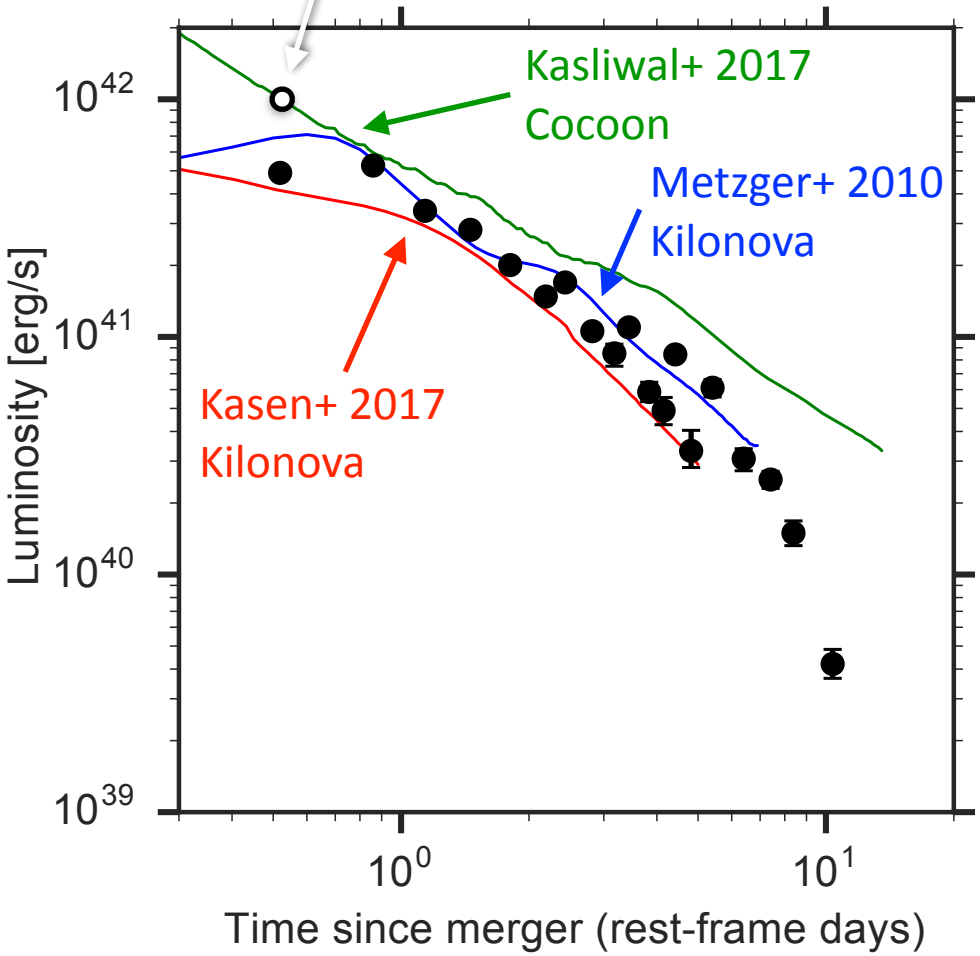
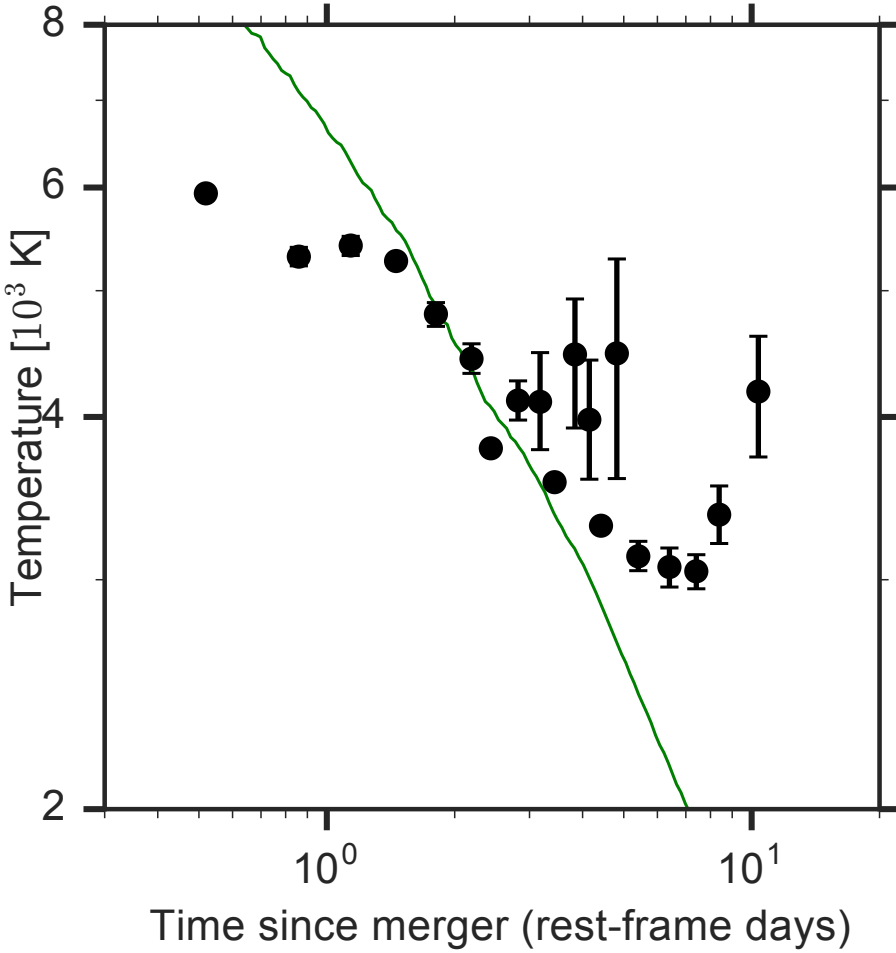




But if Assume a Blackbody…

Some of the published bBolometric light curves start here





Points for Discussion - Optical/UV

What made the blue emission? Can it be fully explained by low-opacity kilonova ejecta? Can it be fully explained by a cocoon? What to we learn about the merger / remnant in each case?

Early data important! If the localization of GW170817 had been released 0.5-1 hour earlier we would have discovered it over South Africa and obtained an earlier photometry point.