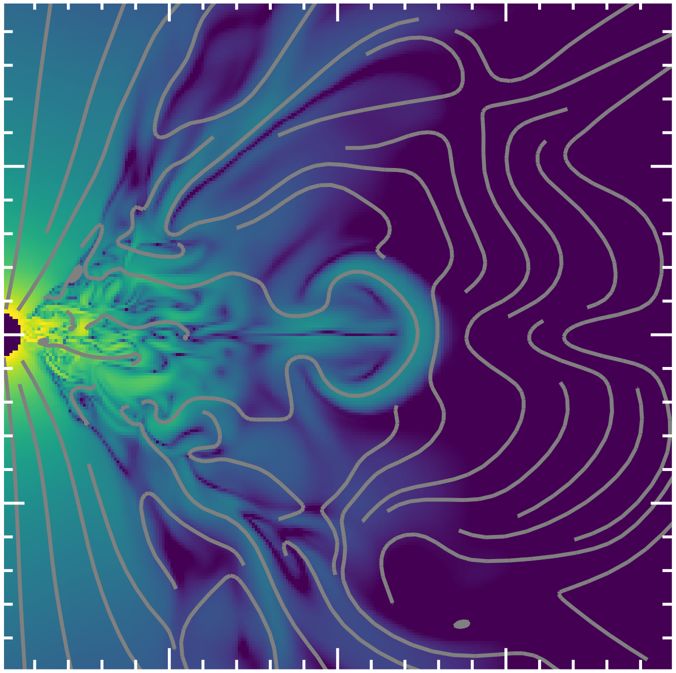
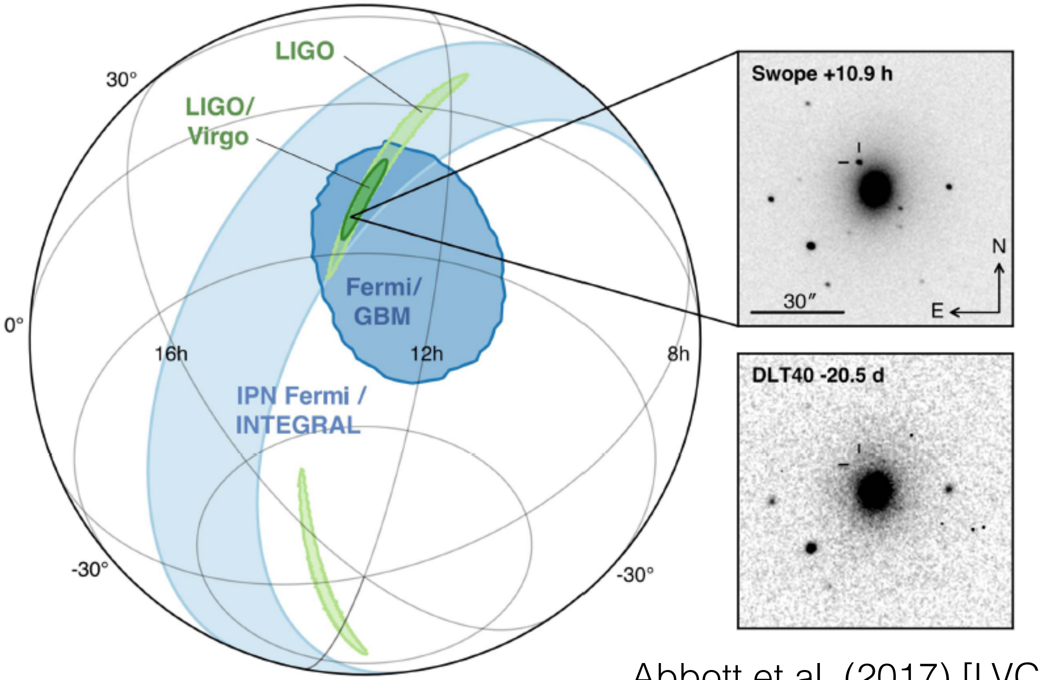




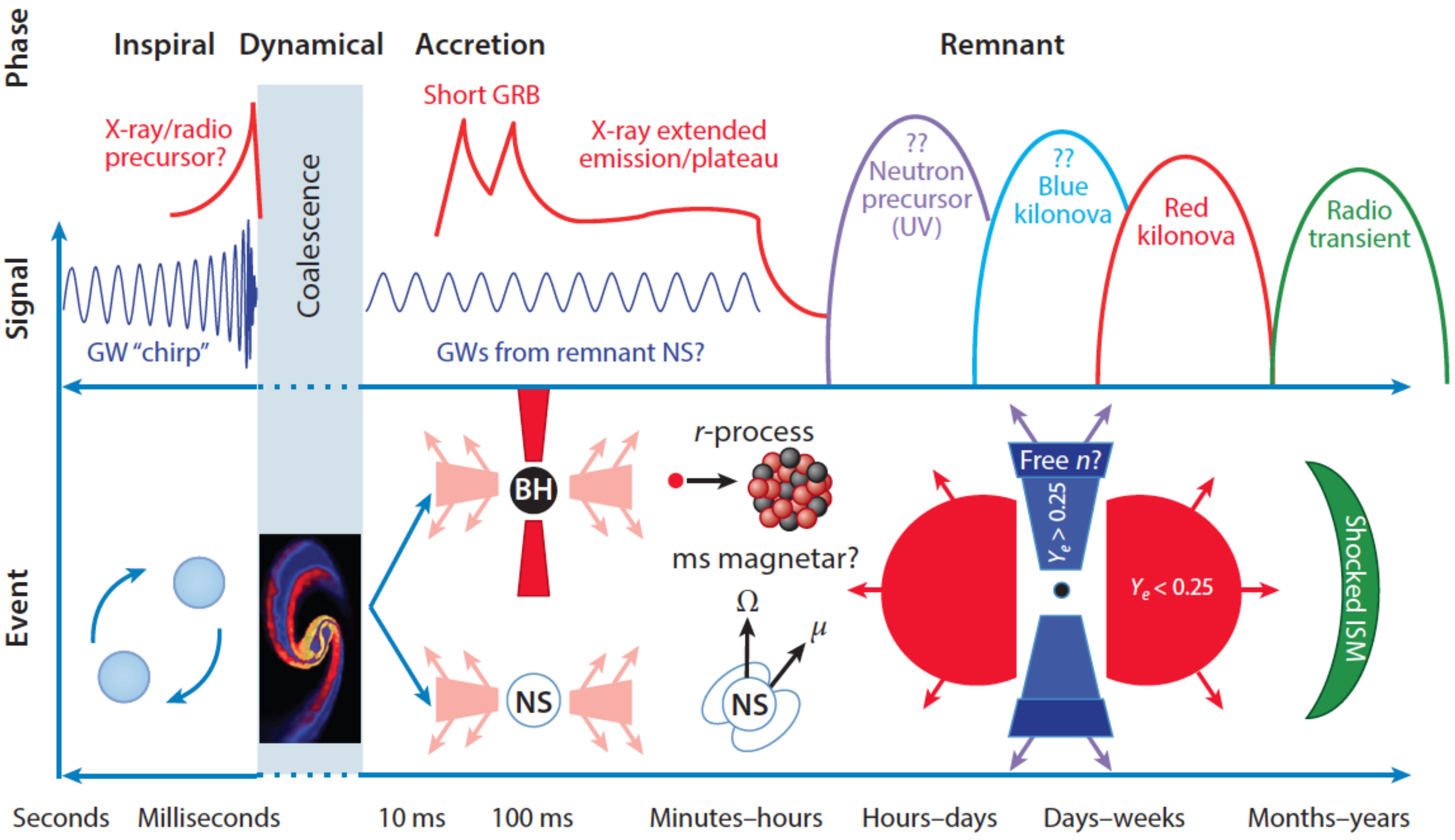
Abbott et al. (2017) [LVC]

The Landscape of Disk Outflows from BH-NS Mergers

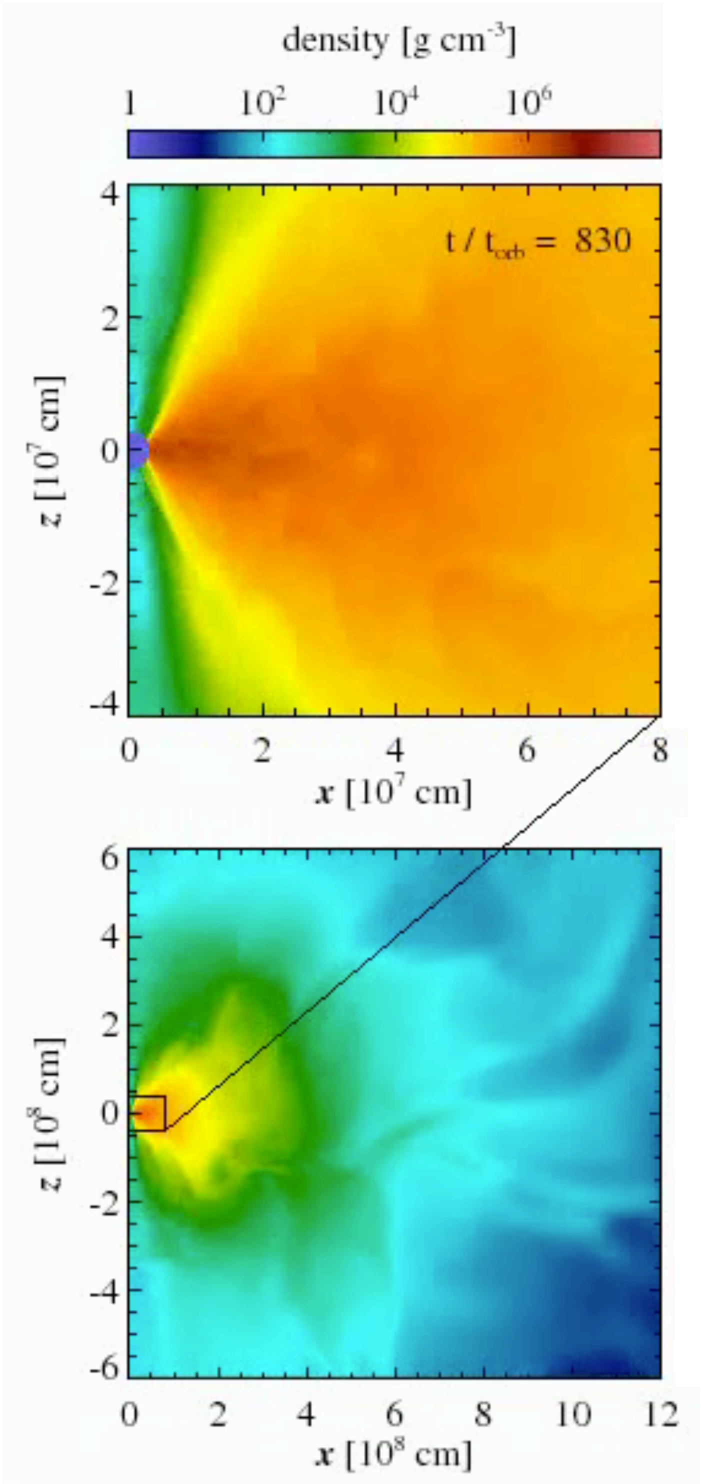
Rodrigo Fernández (University of Alberta)

Francois Foucart (Univ of New Hampshire), Jonas Lippuner (Los Alamos Nat Lab)

Neutron Star Mergers



RF & Metzger (2016)



Wind from remnant accretion disk

- Neutrino cooling shuts down as disk spreads on accretion timescale (~300ms)
- Viscous heating & nuclear recombination are unbalanced
- If BH-disk, eject fraction ~10-20% of initial disk mass, more if HMNS-disk
- Material is neutron-rich (Ye ~ 0.2-0.4), mostly light r-process, some light dep. on parameters
- Mass-averaged wind speed (~0.05c) is slower than dynamical ejecta (~0.1-0.3c)

RF & Metzger (2013)

Just et al. (2015, 2021)

Perego+(2014)

Fujibayashi+(2017, 2020)

Setiawan et al. (2005)

Lee, Ramirez-Ruiz, &
Lopez-Camara (2009)

Metzger (2009)

Hydro: lower limit to mass ejection

	Model	$M_{\rm ejec}$		$\langle v_r \rangle$	$\langle Y_{\rm e} \rangle$
	Name	(%)	($10^{-2}\,M_\odot$)		
GRMHD (3D)	BPS	40	1.3	0.18	0.16
	BPW	30	0.99	0.08	0.19
	BT	27	0.89	0.05	0.18
Hydro (2D)	$\alpha = 0.1$	22	0.67	0.05	0.17
	$\alpha = 0.03$	21	0.63	0.03	0.20
	$\alpha = 0.01$	16	0.48	0.03	0.26

Also:

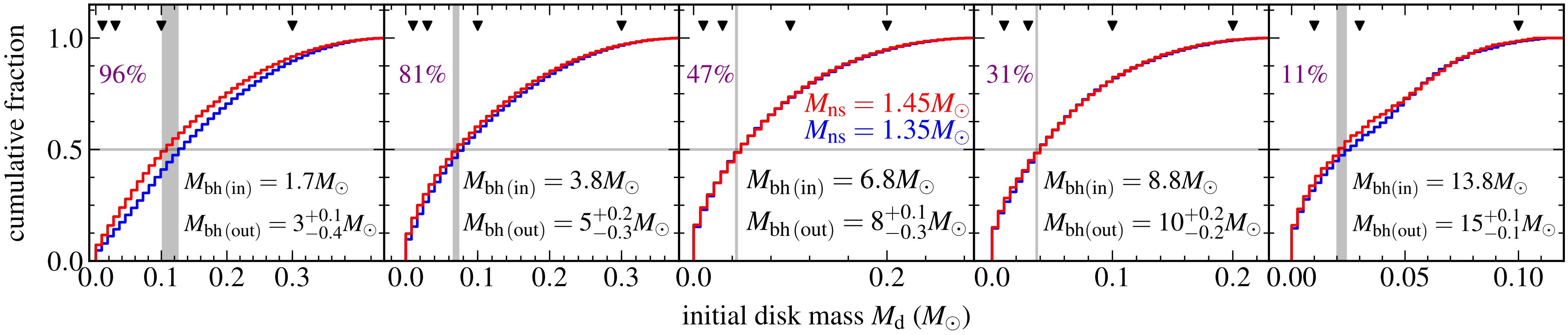
Siegel et al. Just et al.

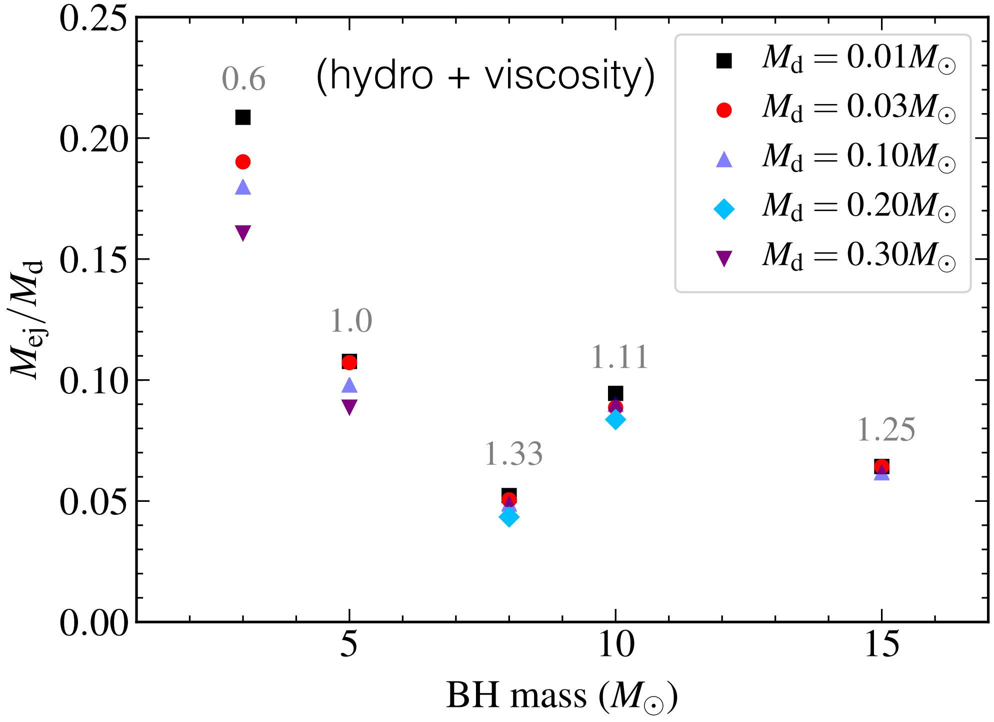
Miller et al. Nouri et al.

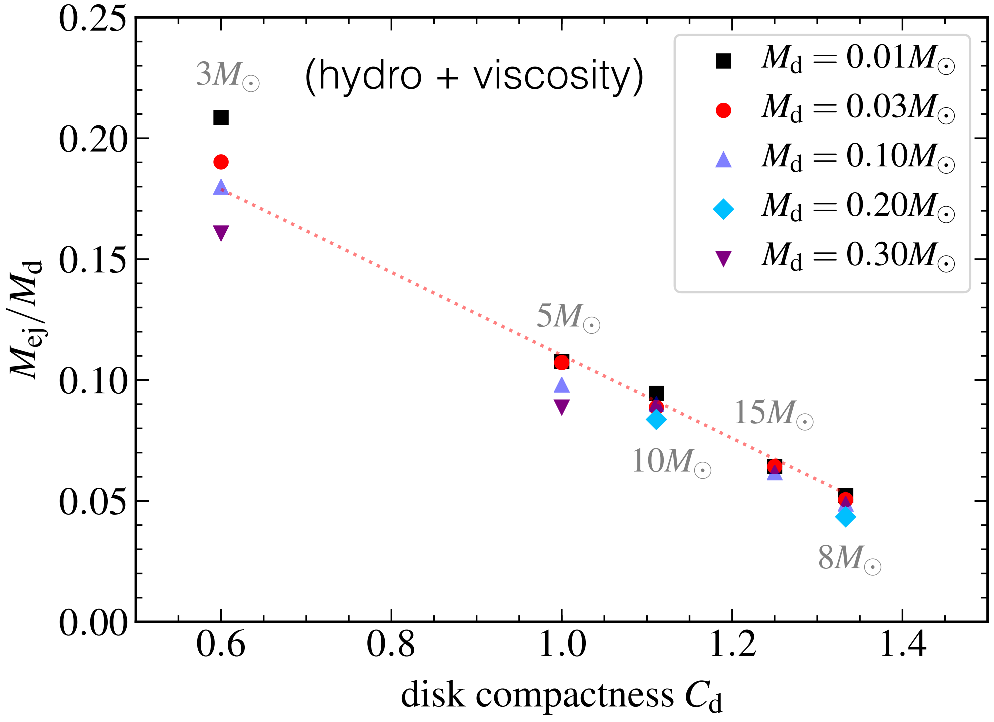
Christie, Lalakos, Tchekhovsoy, RF+ (2019)

RF, Tchekhovskoy+ (2019)

Ejection across BH-NS Parameter Space



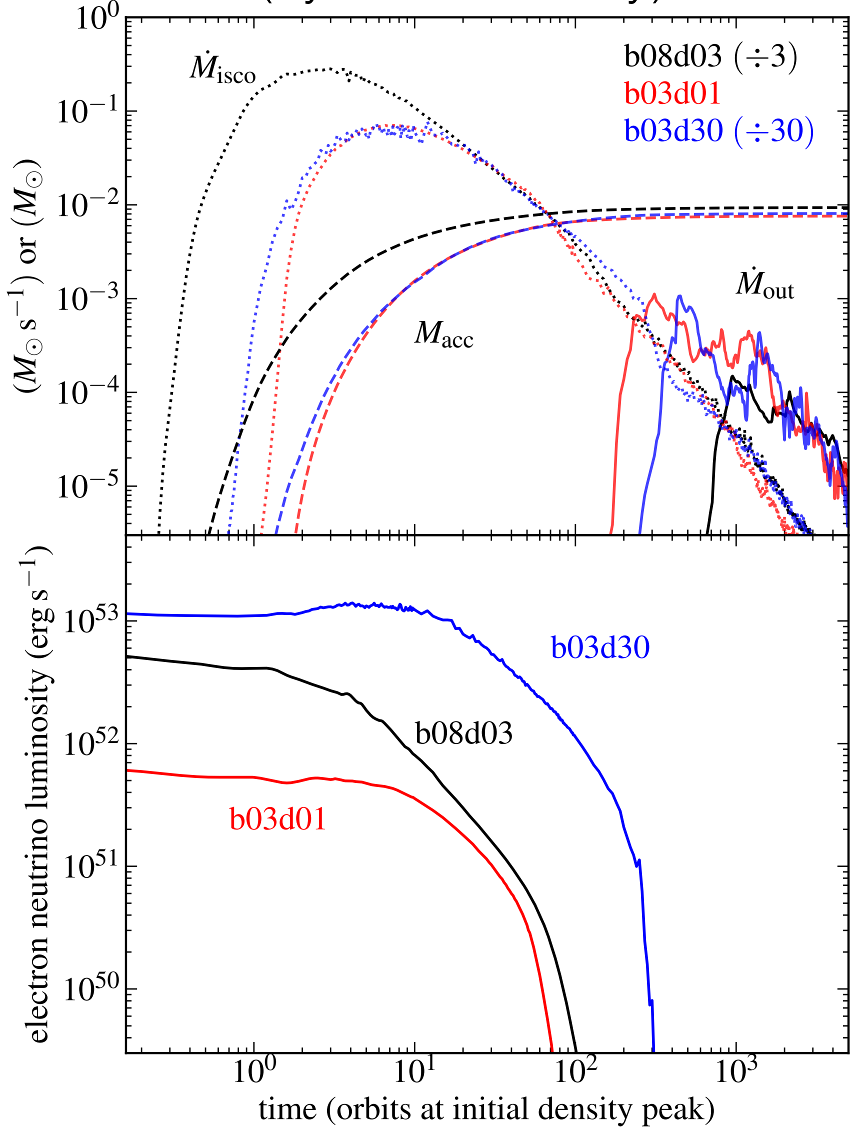




RF, Foucart, & Lippuner (arXiv: 2005.14208)

Ejection Efficiency across Parameter Space

(hydro + viscosity)



Fraction of the initial disk mass ejected depends on disk "compactness":

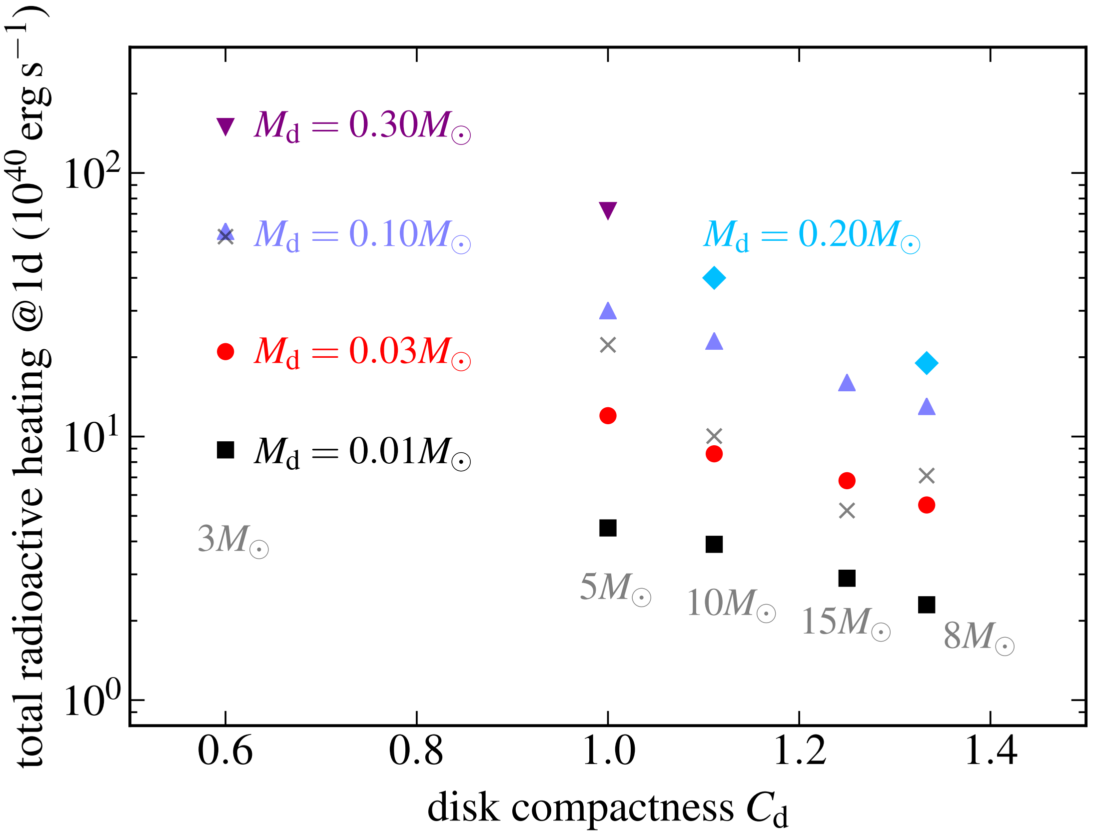
$$C_{\rm d} \propto \frac{M_{\rm bh}}{R_{\rm d}} \propto \frac{r_{\rm isco}}{R_{\rm d}}$$

Ejected fraction also depends on disk mass: longer time to freeze out neutrino emission

RF, Foucart, & Lippuner (arXiv: 2005.14208)

Contribution to Kilonova

Radioactive luminosity covers factor of 100 (subject to thermalization and radiation transport effects)



RF, Foucart, & Lippuner (arXiv: 2005.14208)

No EM counterparts detected in O3 events. These included at least 1 well-localized BH-NS candidate with extensive coverage.

KN constraints on ejecta from GW190814 means most of BH-NS parameter space of disk ejection would be below detection.

See **Raaijmakers+21** for an application of disk fraction results to parameter inference from GW+EM detections.

Foucart talk S03

Summary

1. Ejected fraction in BH-NS disks evolved in viscous hydrodynamics depends on disk compactness and disk mass (in addition to the known dependence on strength of viscosity). Dependence to be further investigated in MHD (**Fahlman talk G09**)

2. Over most of BH-NS parameter space, radioactive energy generation can vary by factor ~100, large range of possible disk-powered kilonovae.

3. Ejected fraction depends on ratio of ISCO to disk size (compactness) and time to freeze out neutrino processes (dependent on disk mass).

Thanks to:

UNIVERSITY OF ALBERTA

NSERC CRSNG

NERSC

U.S. DEPARTMENT OF ENERGY | Office of Science

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