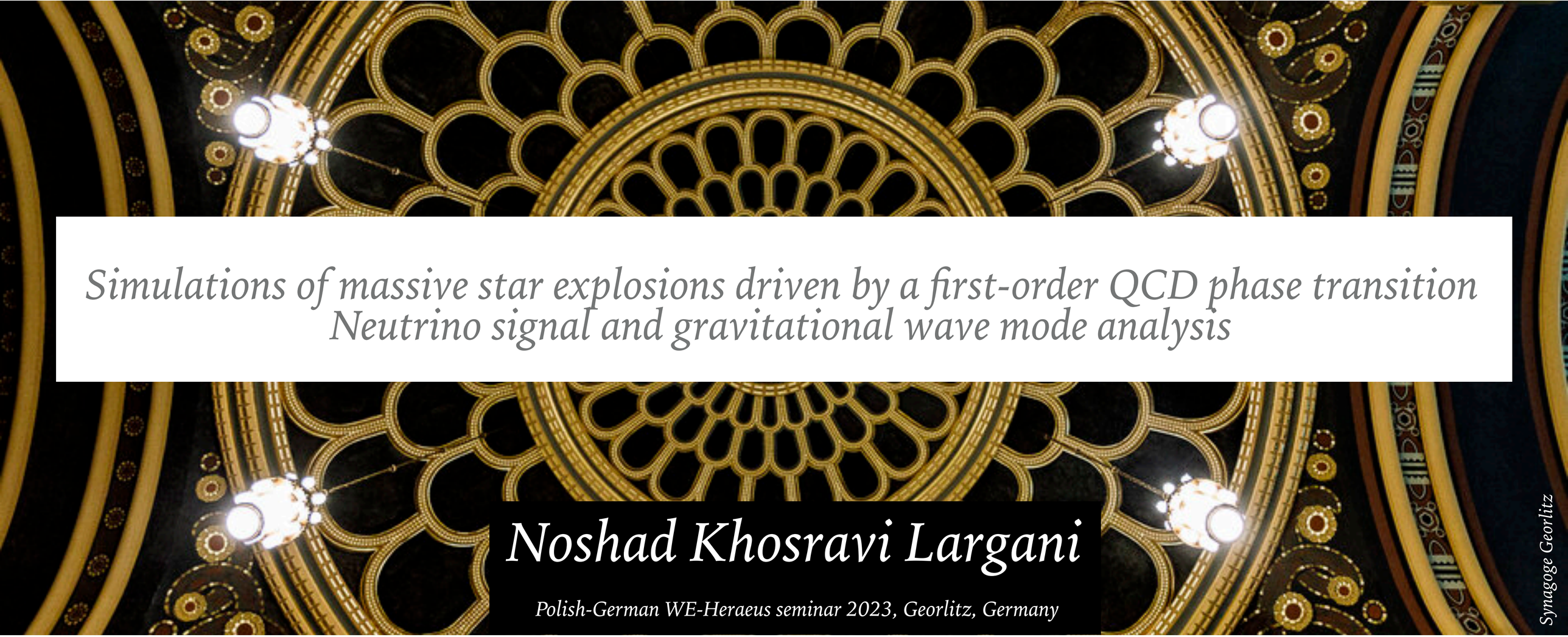


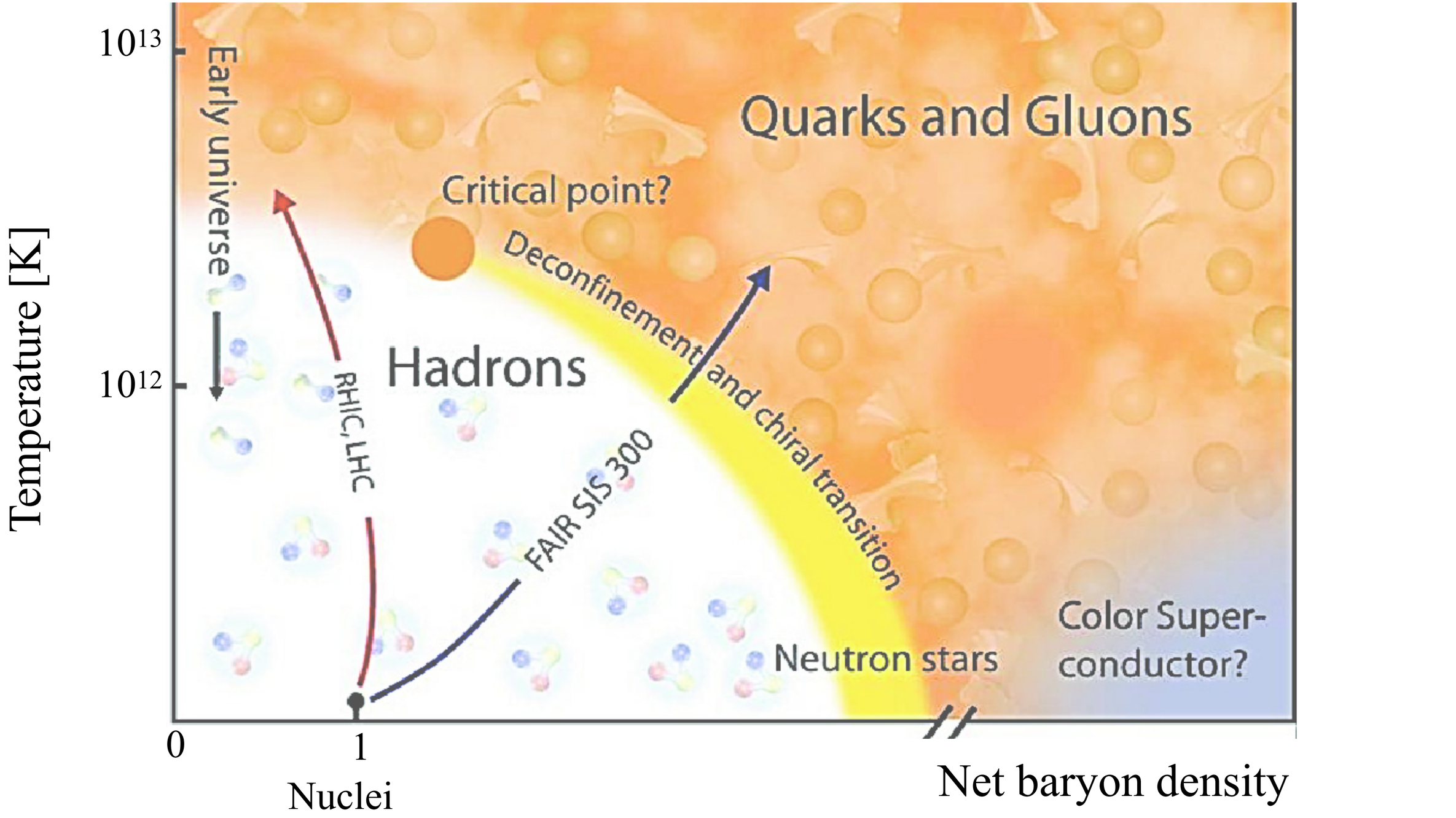
Simulations of massive star explosions driven by a first-order QCD phase transition Neutrino signal and gravitational wave mode analysis

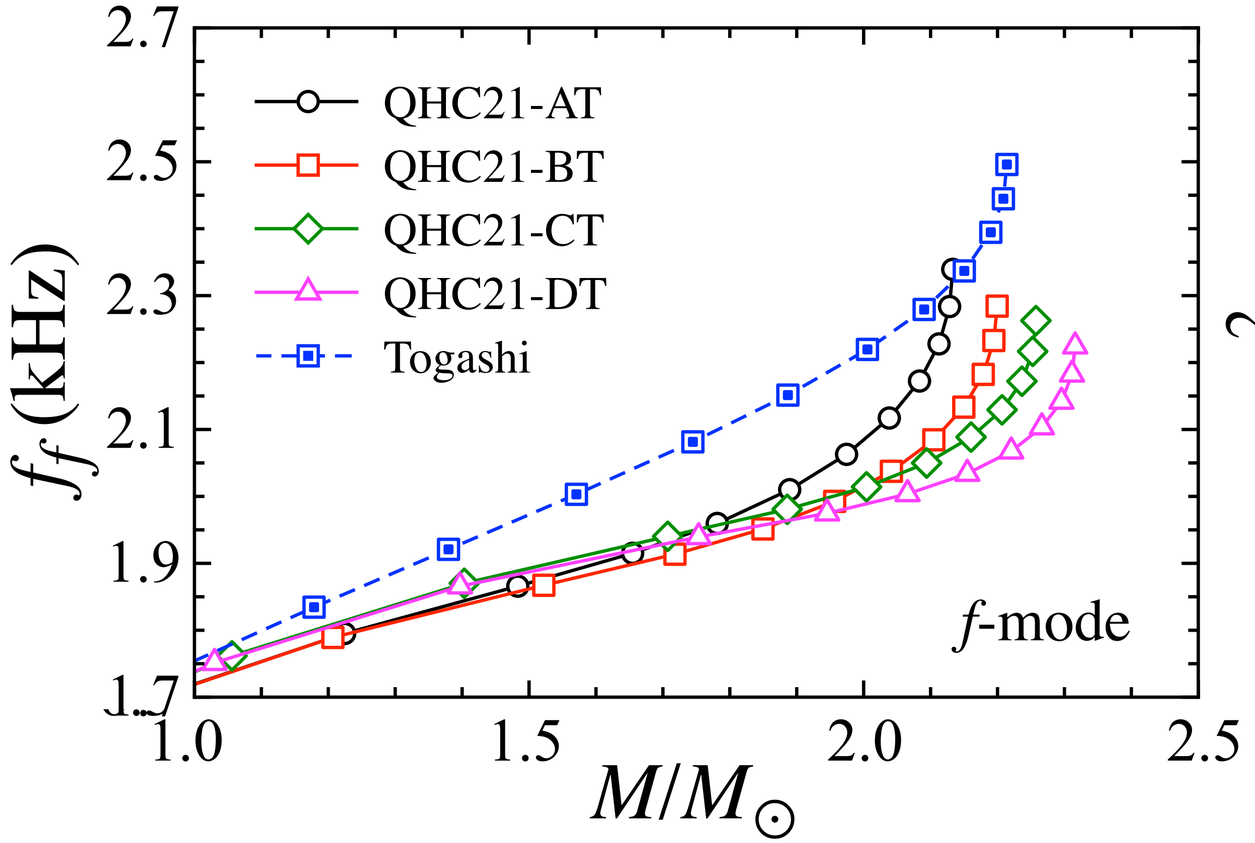
Noshad Khosravi Largani

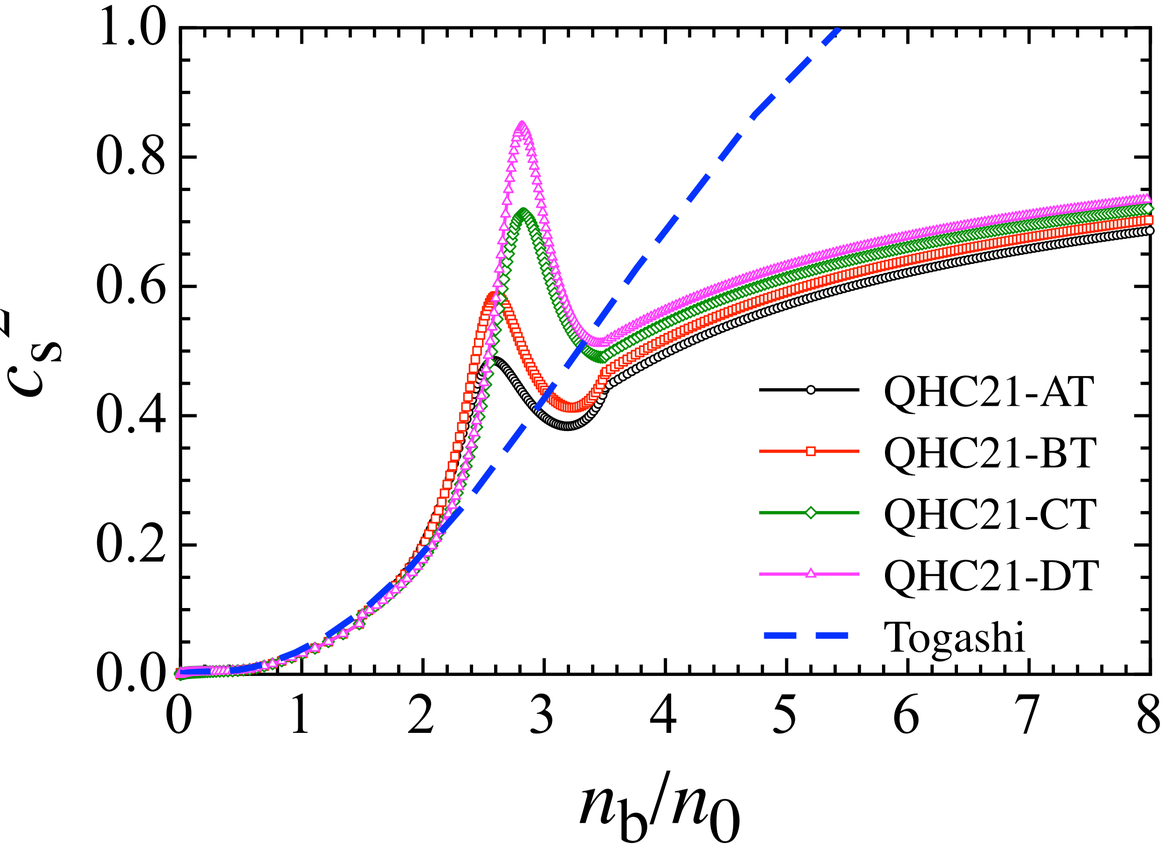
Polish-German WE-Heraeus seminar 2023, Georlitz, Germany

Synagoge Georlitz

Uniwersytet Wrocławski

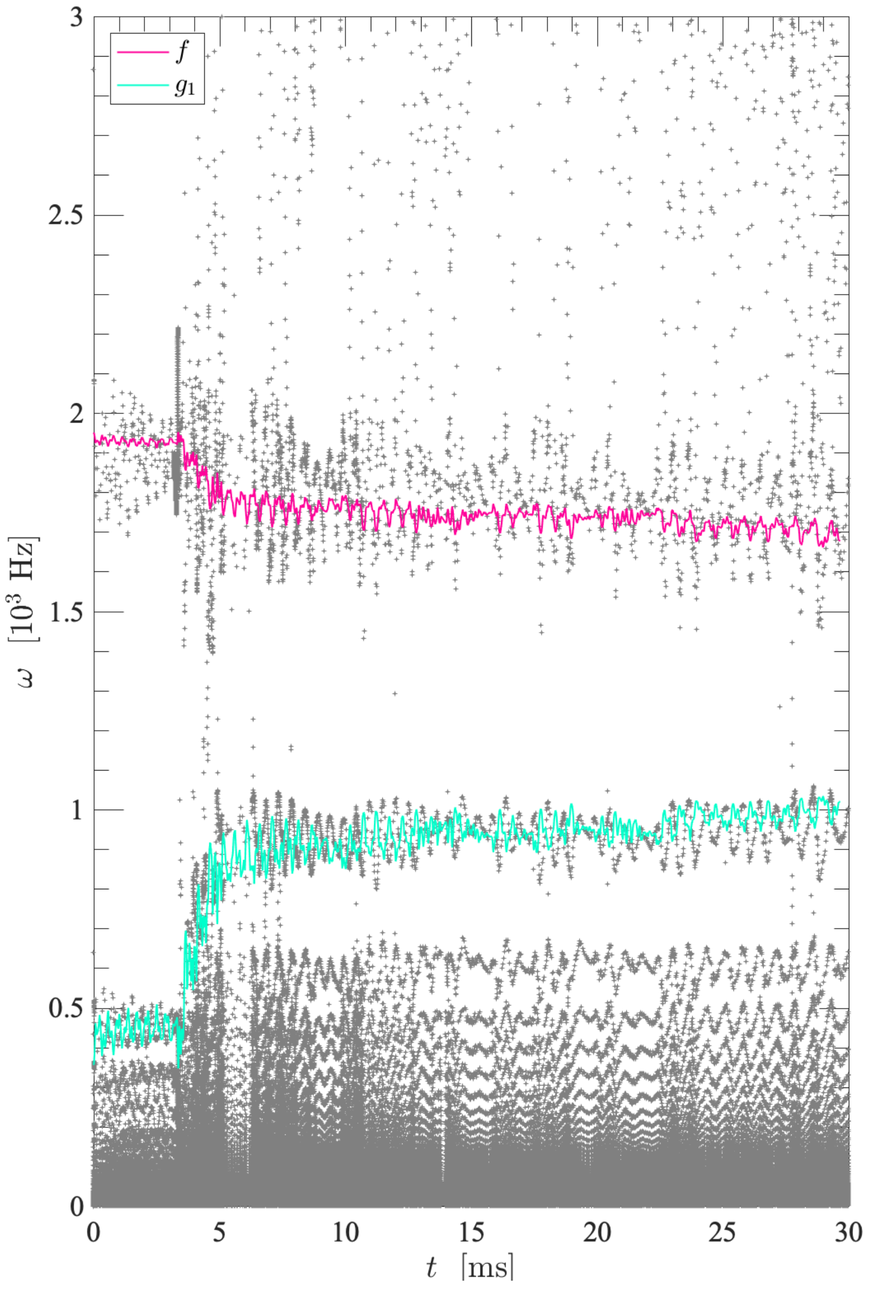

Temperature [K]
10^{13}
10^{12}
Early universe
Quarks and Gluons
Critical point?
Deconfinement and chiral transition
Hadrons
RHIC, LHC
FAIR SIS 300
Neutron stars
Color Super-
conductor?
0
1
Nuclei
Net baryon density

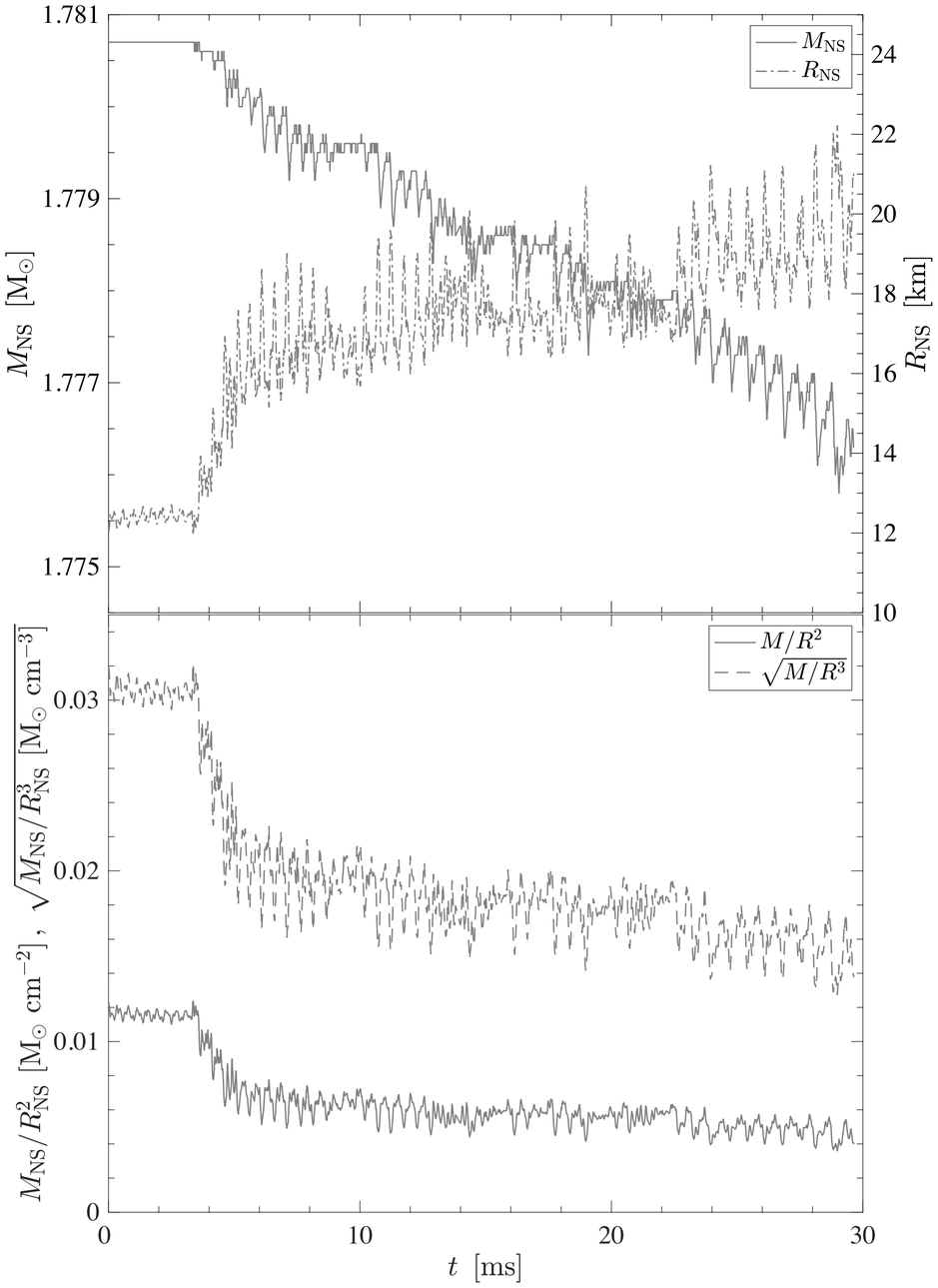




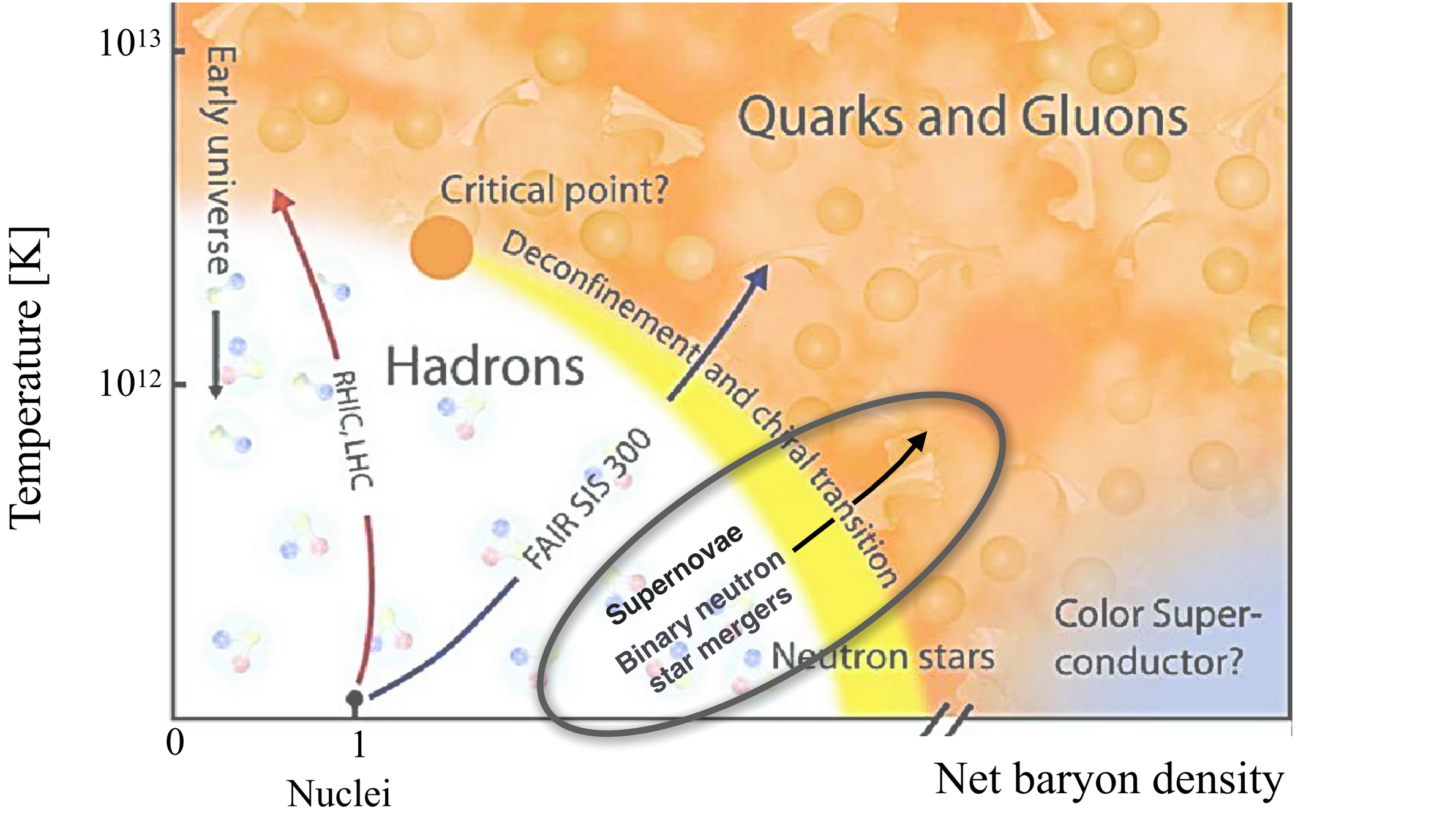
Sotani et al. Phys.Rev. D, 108, 063004 (2023)

$M_{\rm NS} = 1.55\ M_\odot$





Khosravi Largani et al. A&A (submitted)


Temperature [K]
10^{13}
10^{12}
Early universe
Quarks and Gluons
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Deconfinement and chiral transition
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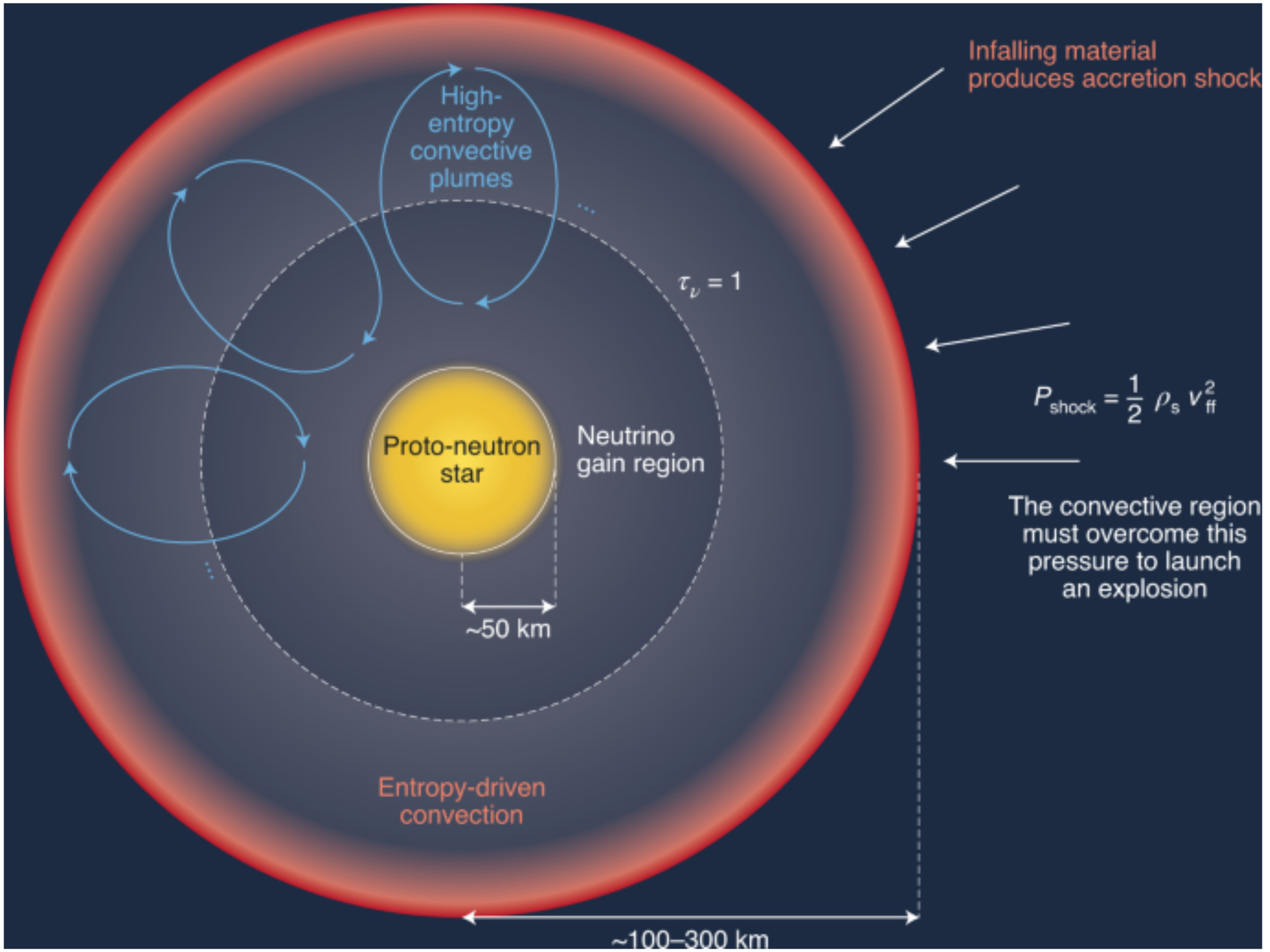
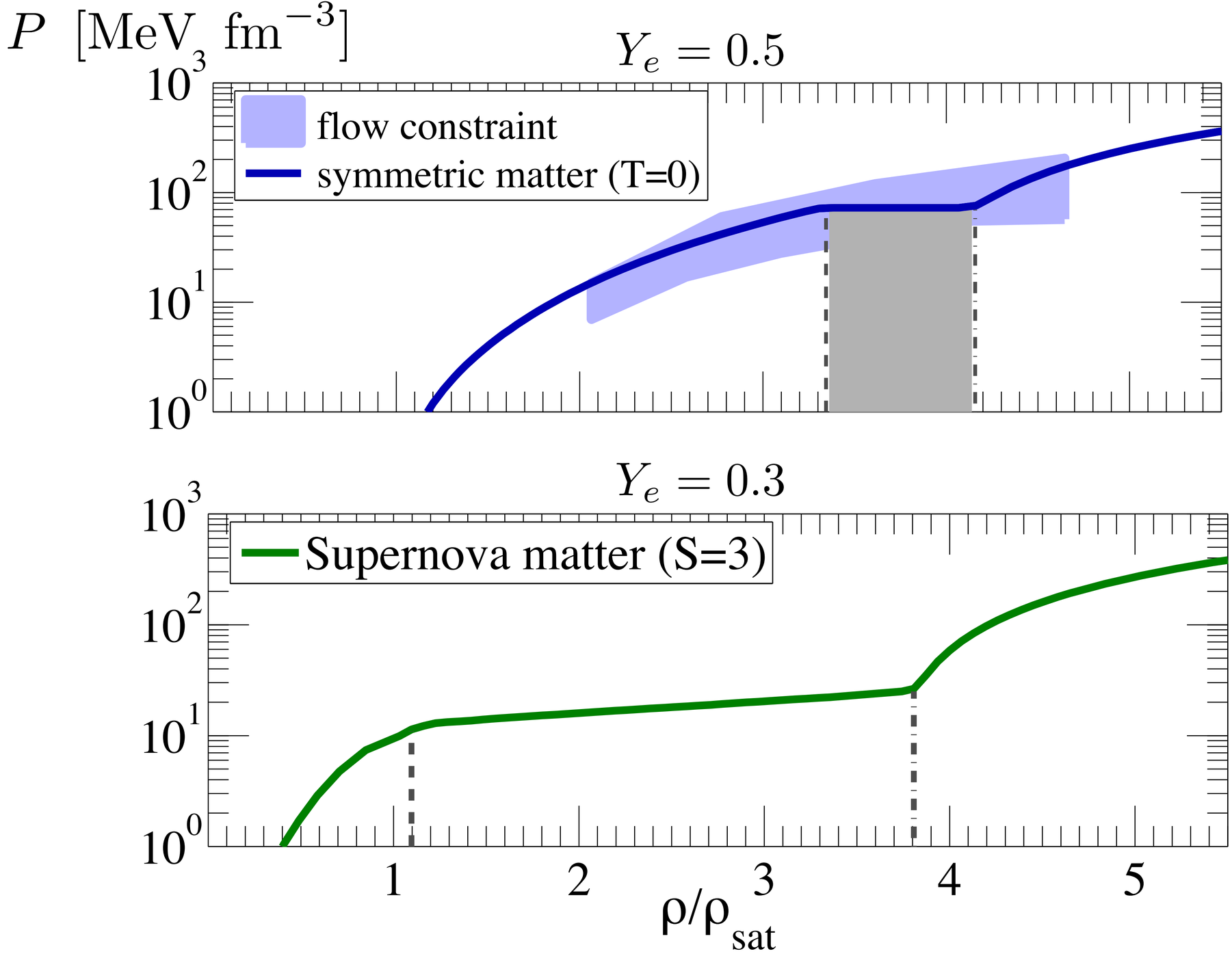
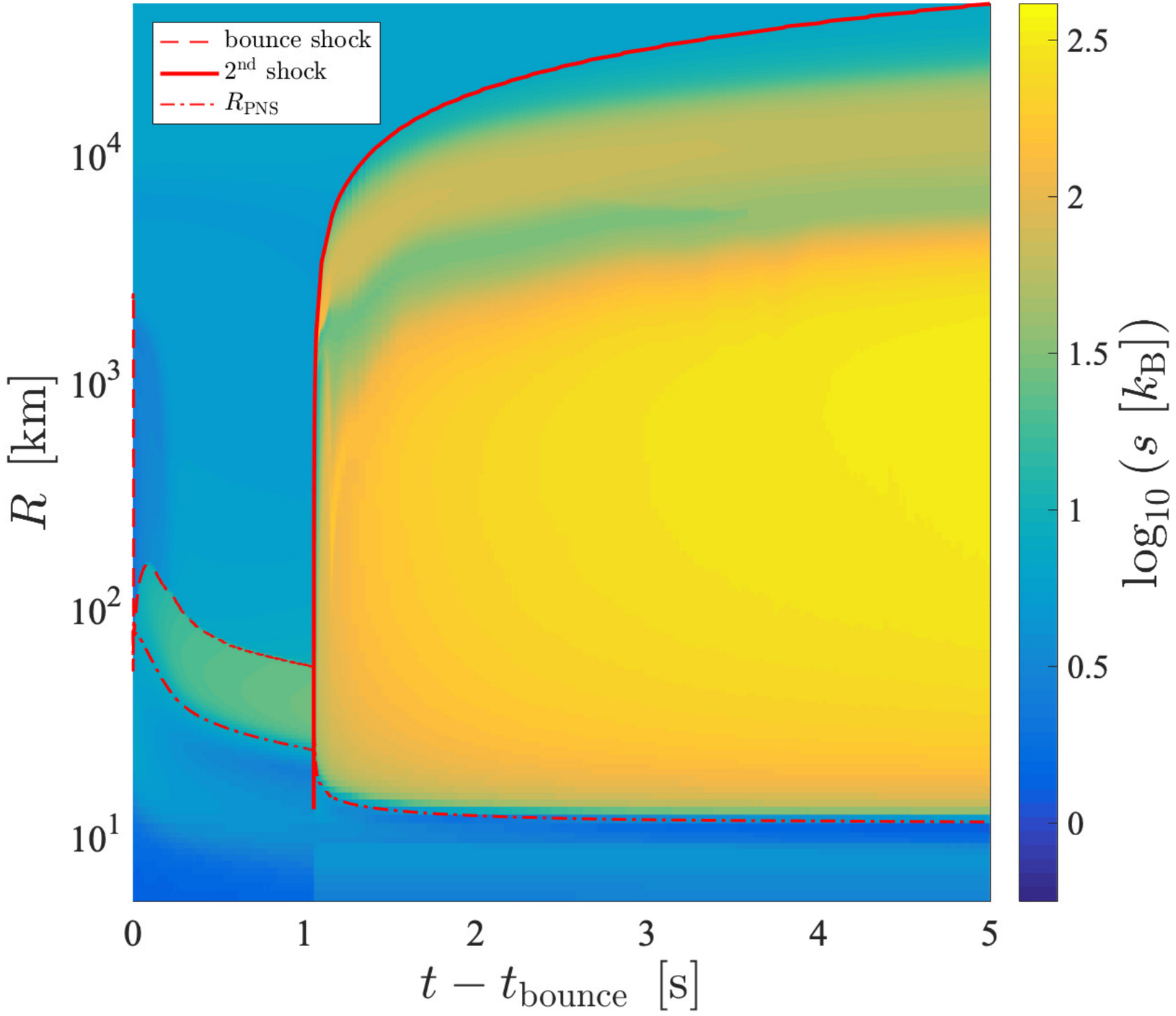
FAIR SIS 300
Supernovae
Binary neutron star mergers
Neutron stars
Color Super-conductor?
0
1
Nuclei
Net baryon density



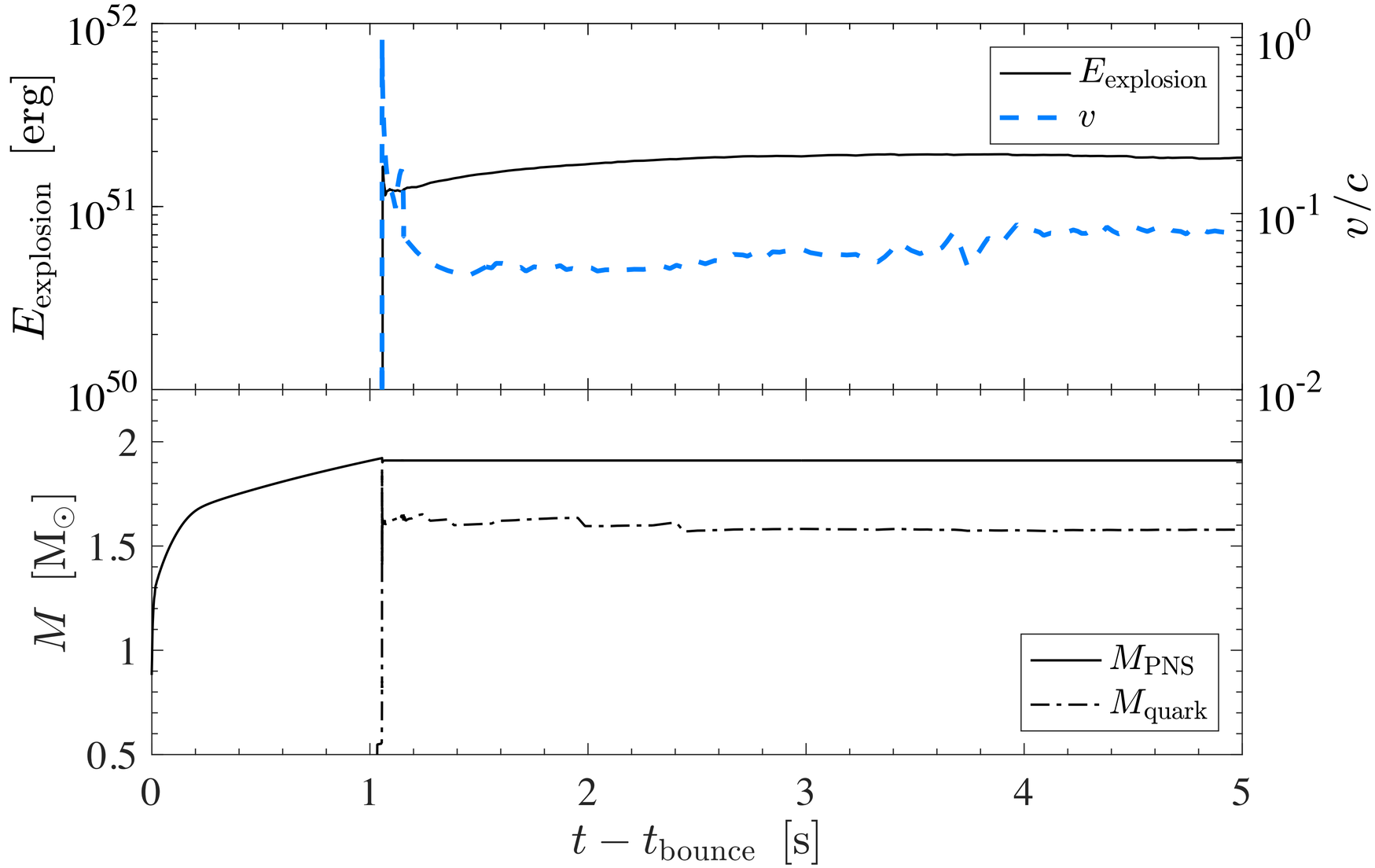
Young, P. Nat Astron **5,** 434–435 (2021)



Bastian, Phys. Rev. D, 103, 023001 (2021)



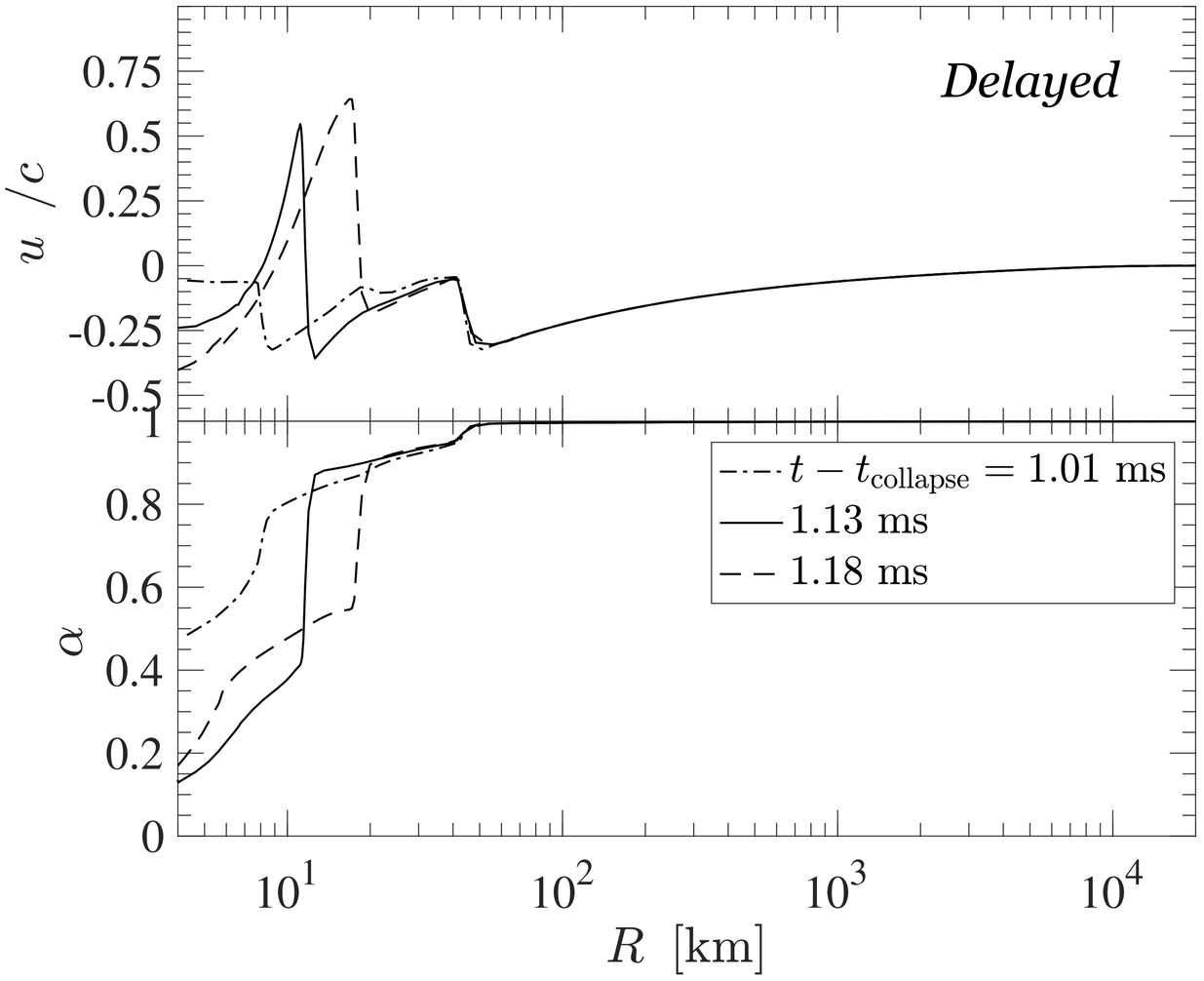
Khosravi Largani et al., APJ, (under revision) (2023)

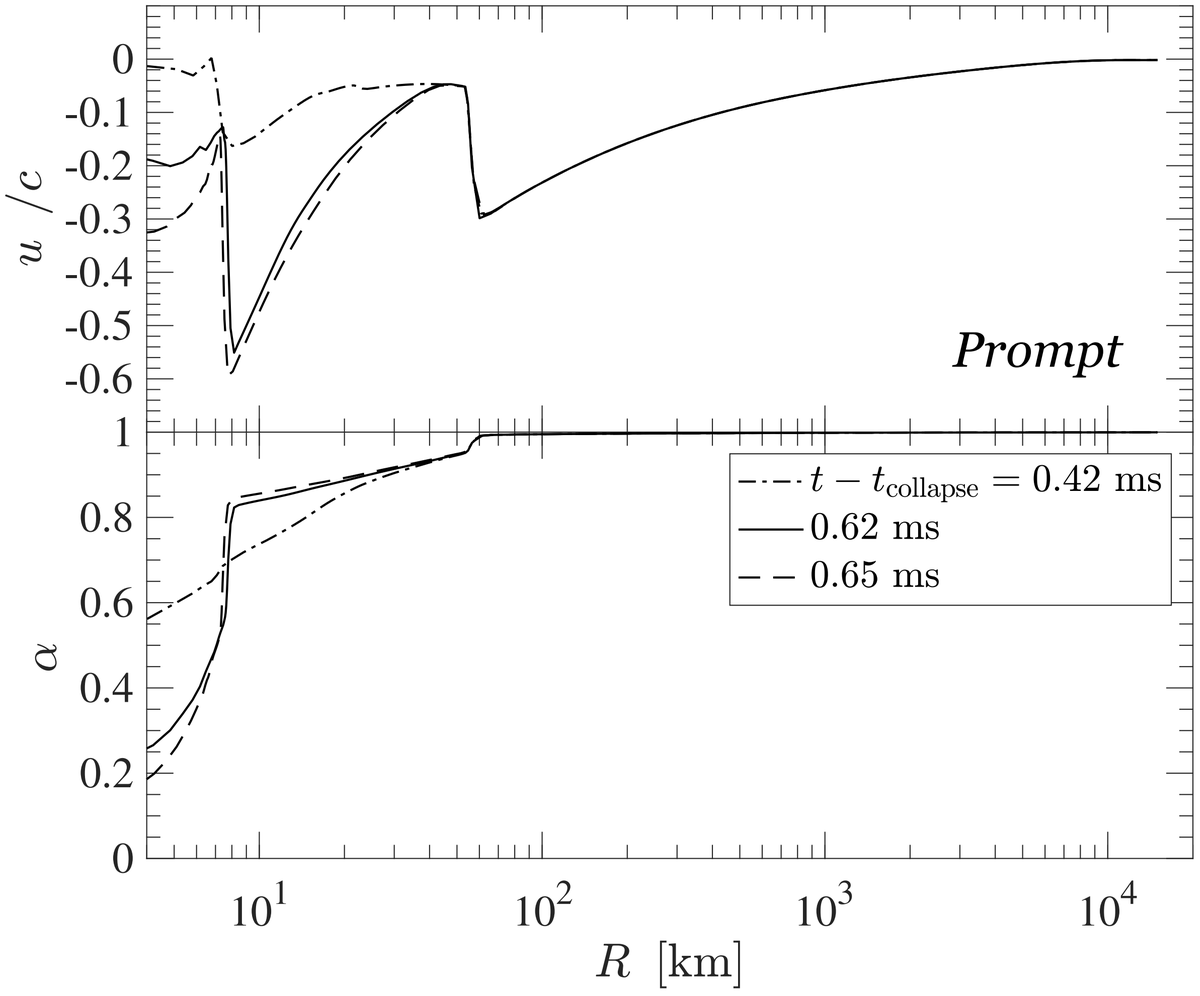


$$\mathrm{E_{expl}} = 3 \times 10^{51}\ \mathrm{erg}$$

$$\mathrm{M_{NS}} \simeq 2\ \mathrm{M_\odot}$$

Black-hole formation: **Two distinct scenarios**

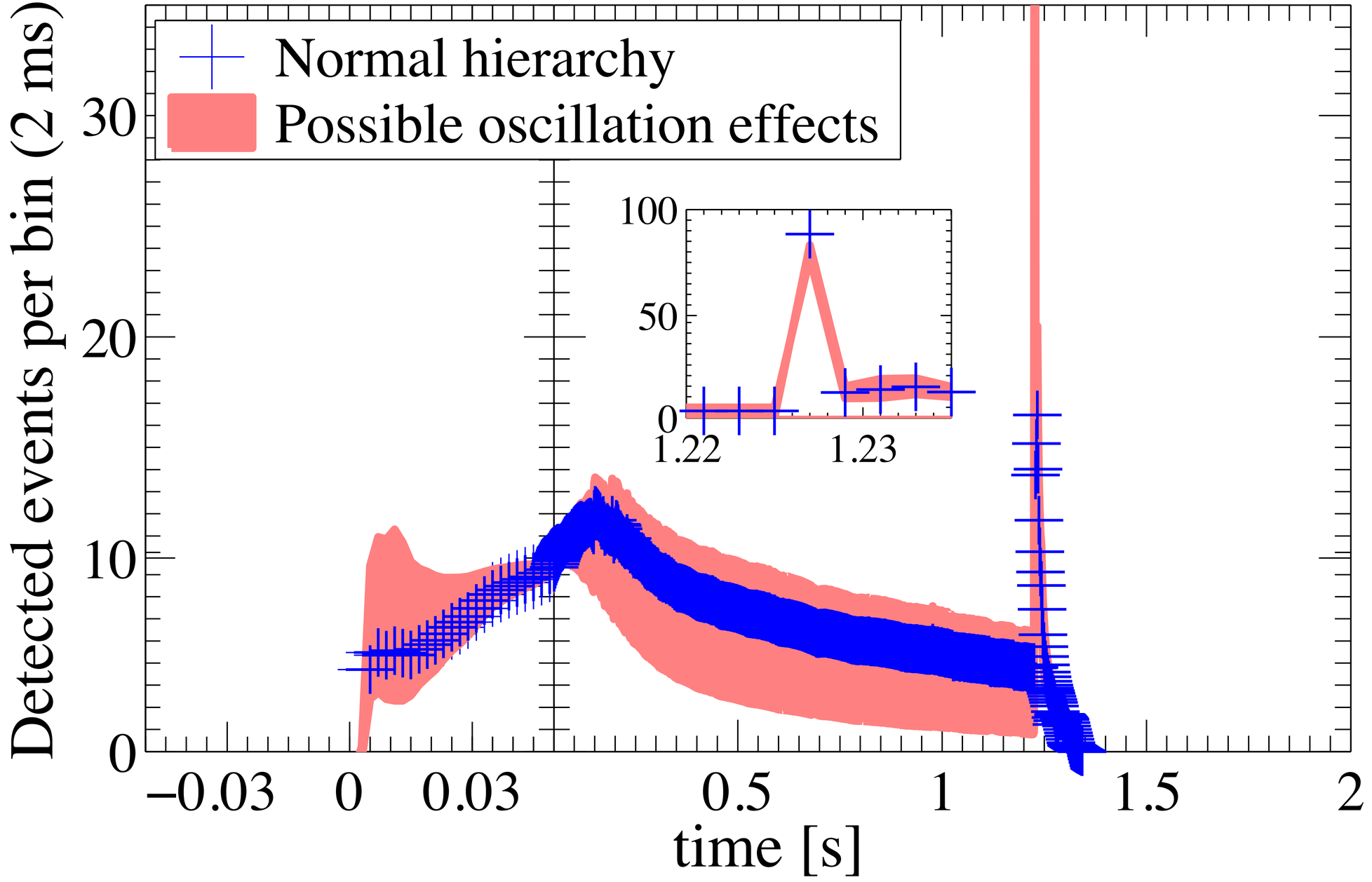




Jakobus et al., MNRAS, 516, 2554 (2022)

Khosravi Largani et al., ApJ (under revision) (2023)

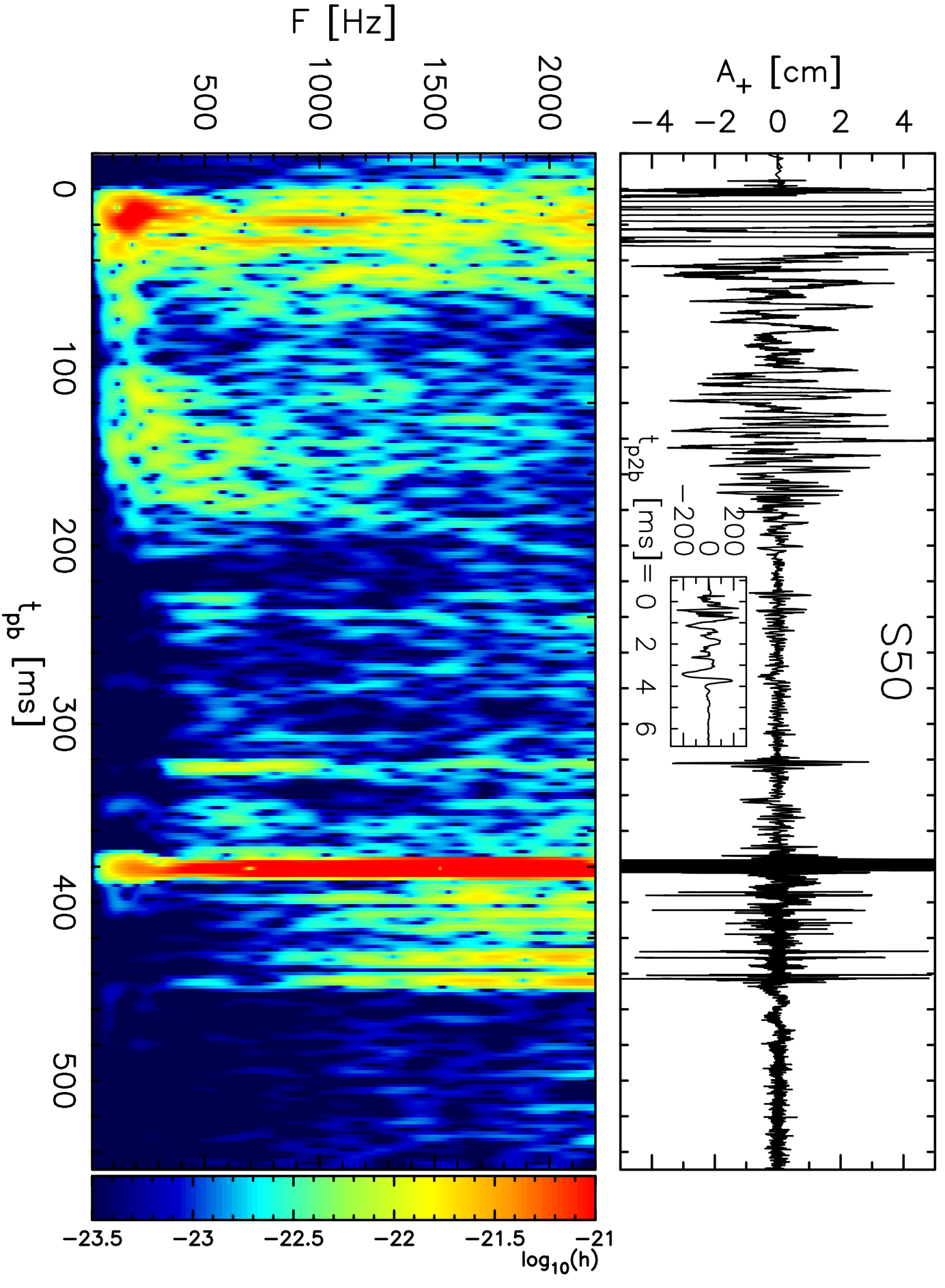
ν – signal @ Super-Kamiokande (d ~ 10 kpc)

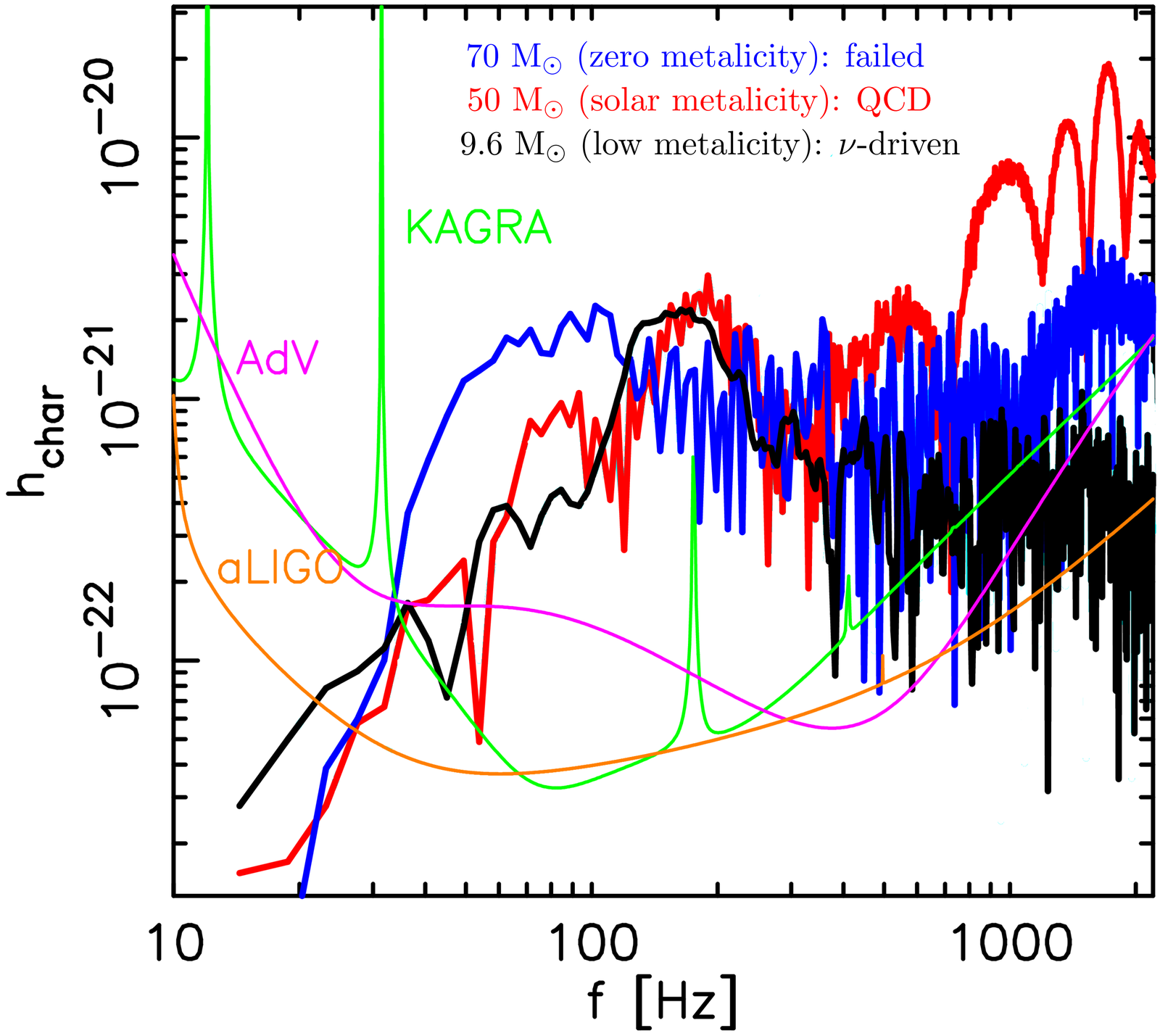


Fischer et al., Nature Astron. 2, 980 (2018)

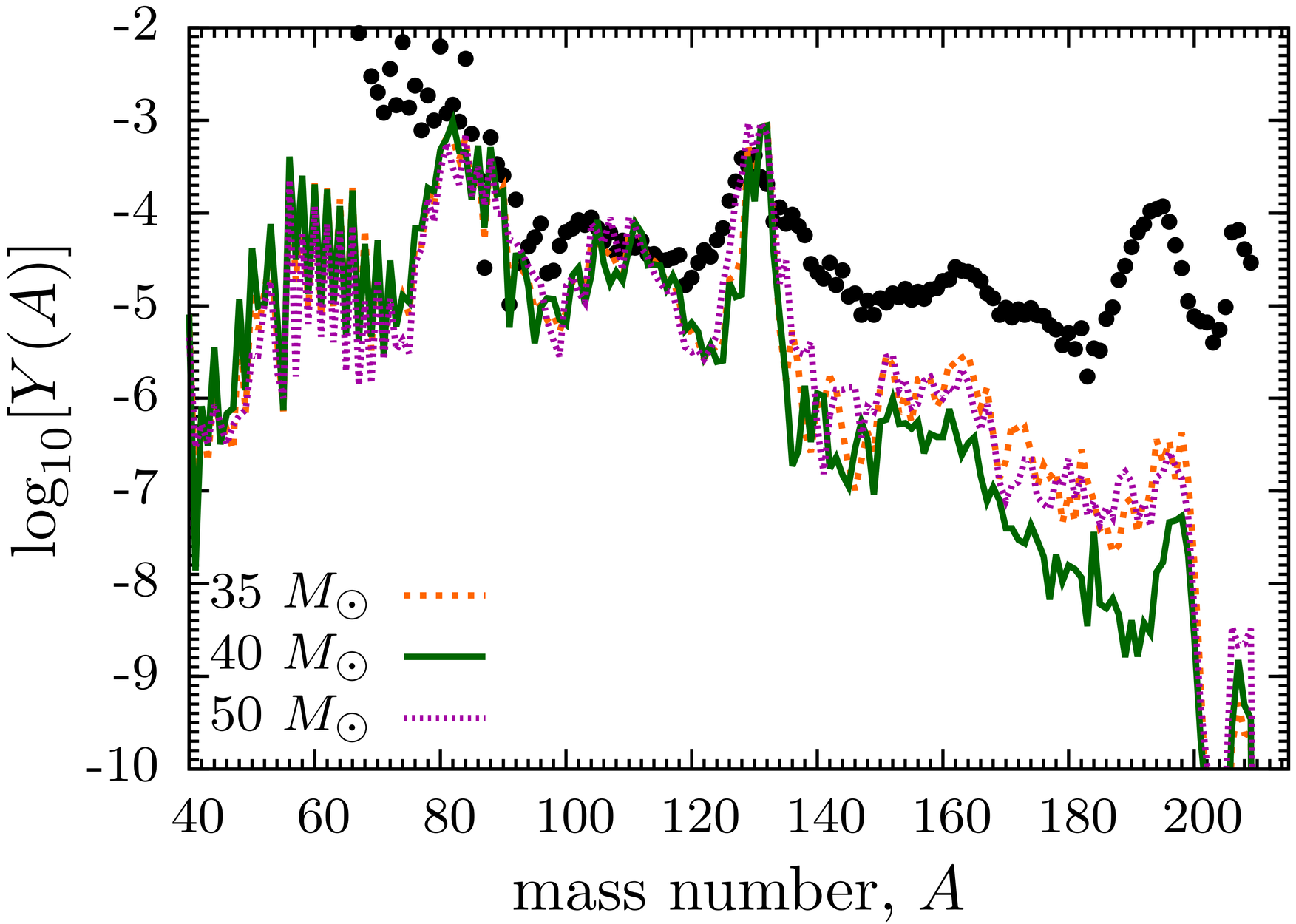
Kuroda et al., ApJ 924, 38 (2022)

Zha et al., PRL 125, 051102 (2020)

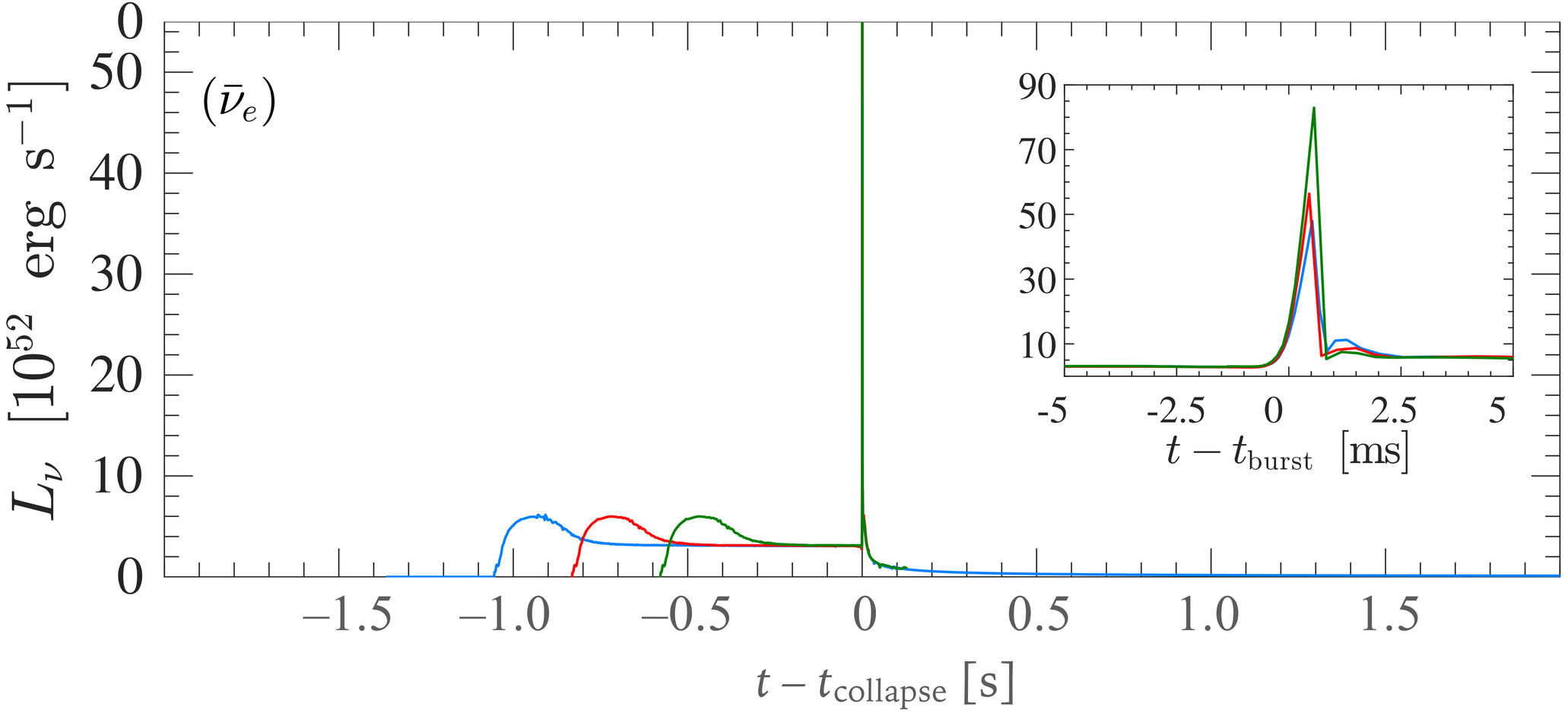




Kuroda et al., ApJ 924, 38 (2022)

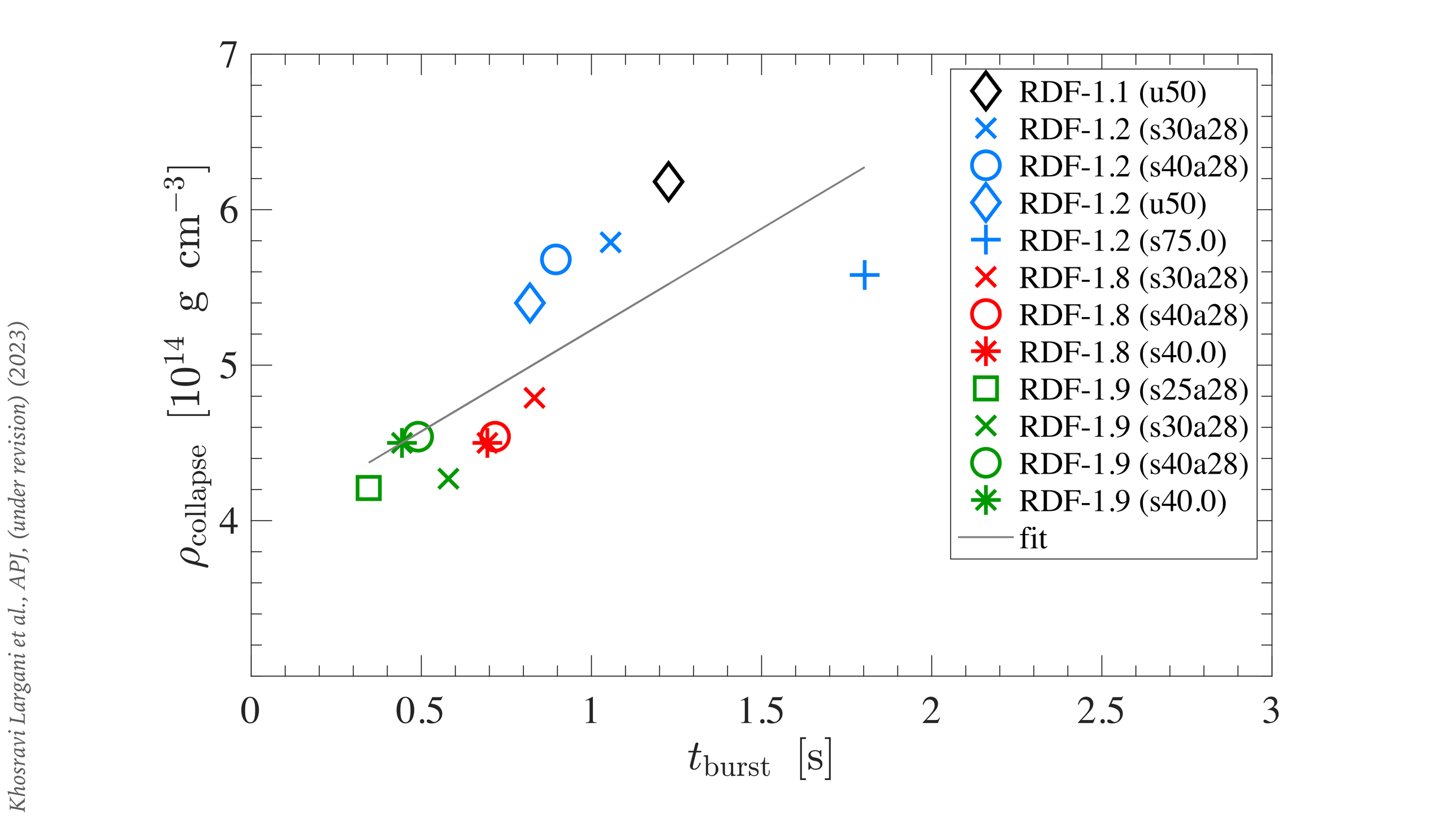


Fischer et al., ApJ 894, 9 (2020)

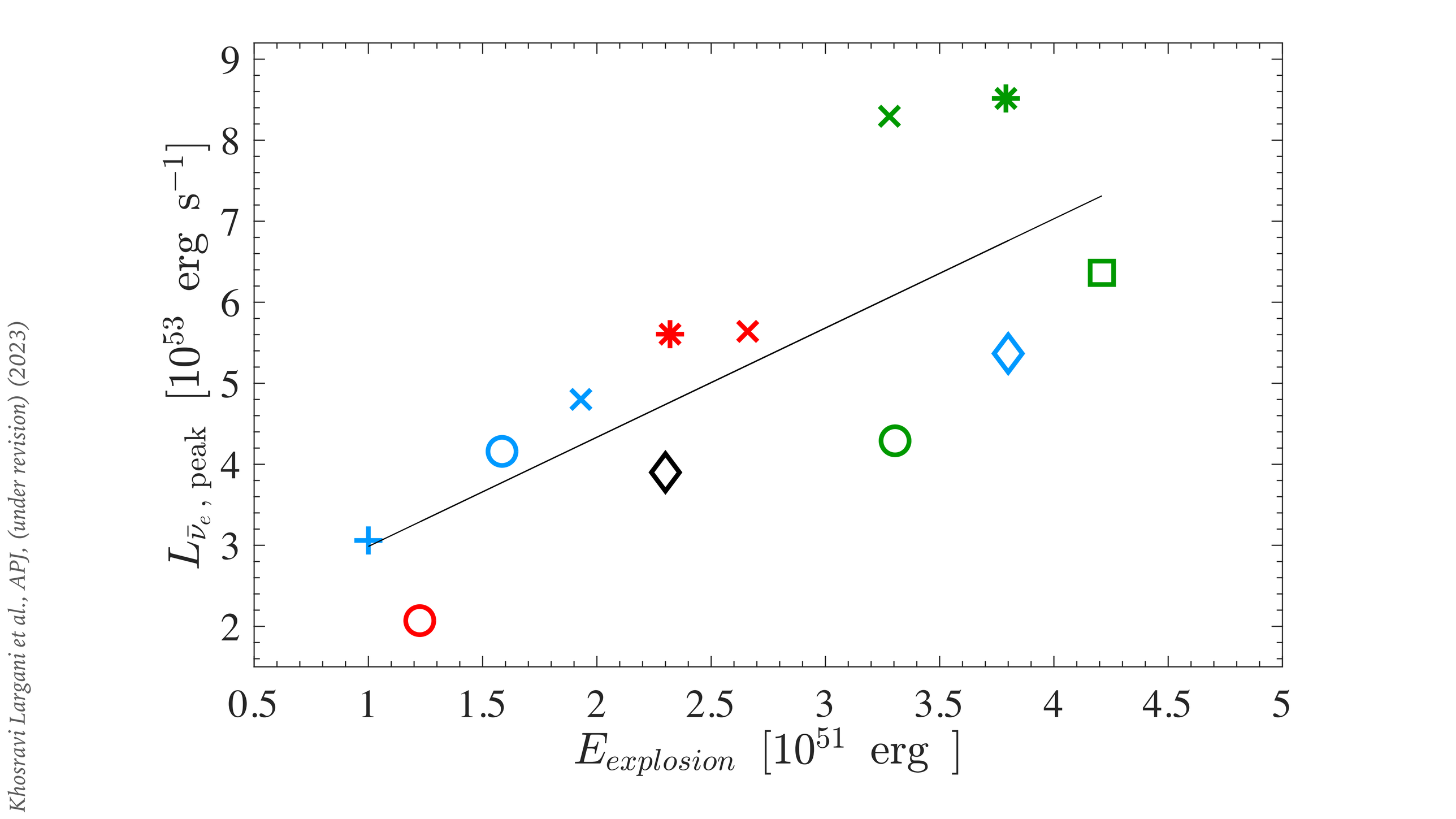


Khosravi Largani et al., ApJ (under revision) (2023)

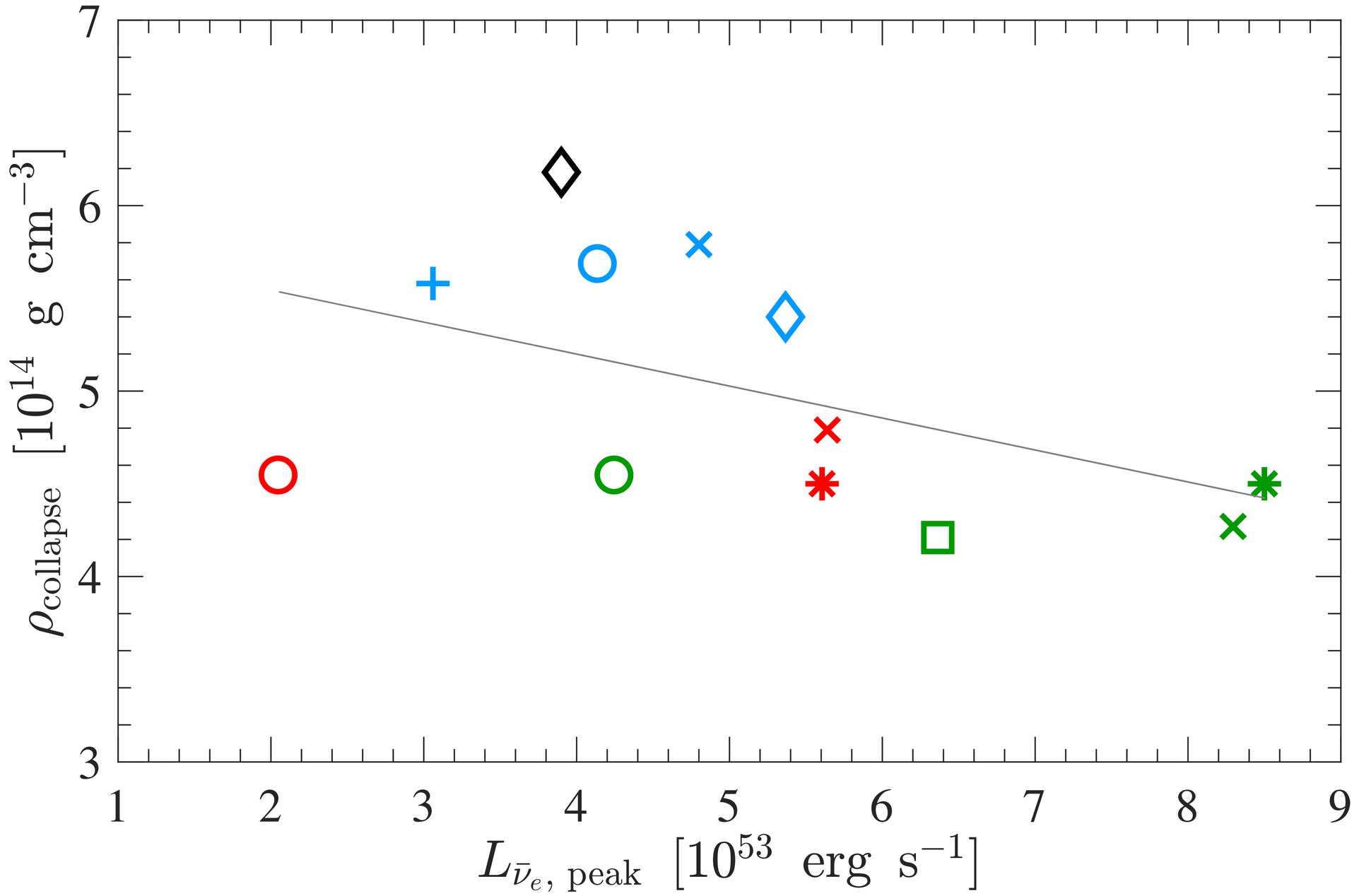
Progenitor	EOS RDF	$t_{\rm burst}$ [s]	$L_{\bar{\nu}_e,\rm peak}$ [10^{53} erg s^{-1}]	$\langle E_{\bar{\nu}_e}\rangle$ [MeV]	$E_{\rm expl}$ [10^{51} erg]
s25a28	1.9	0.345	6.36	38.59	4.21
s30a28	1.2	1.056	4.80	56.21	1.93
s30a28	1.8	0.833	5.64	42.21	2.66
s30a28	1.9	0.580	8.30	43.49	3.28
s40a28	1.2	0.895	4.15	38.60	1.59
s40a28	1.8	0.717	2.06	35.77	1.23
s40a28	1.9	0.491	4.28	39.94	3.31
s40.0	1.8	0.694	5.61	43.03	2.32
s40.0	1.9	0.443	8.52	48.69	3.79
u50	1.1	1.227	3.90	26.55	2.3
u50	1.2	0.819	5.37	36.19	3.8
s75.0	1.2	1.803	3.06	34.35	1.0



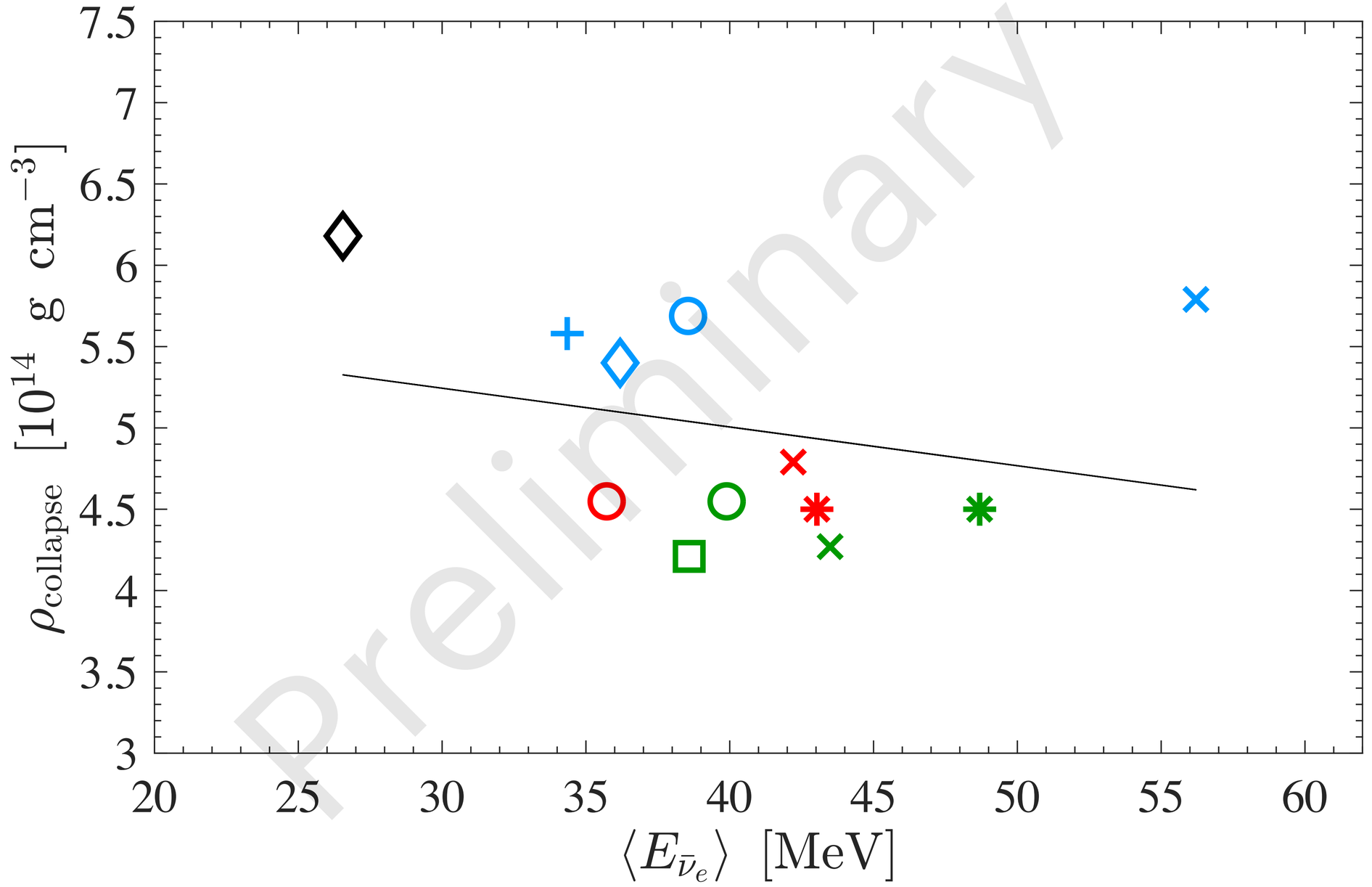
Khosravi Largani et al., APJ, (under revision) (2023)

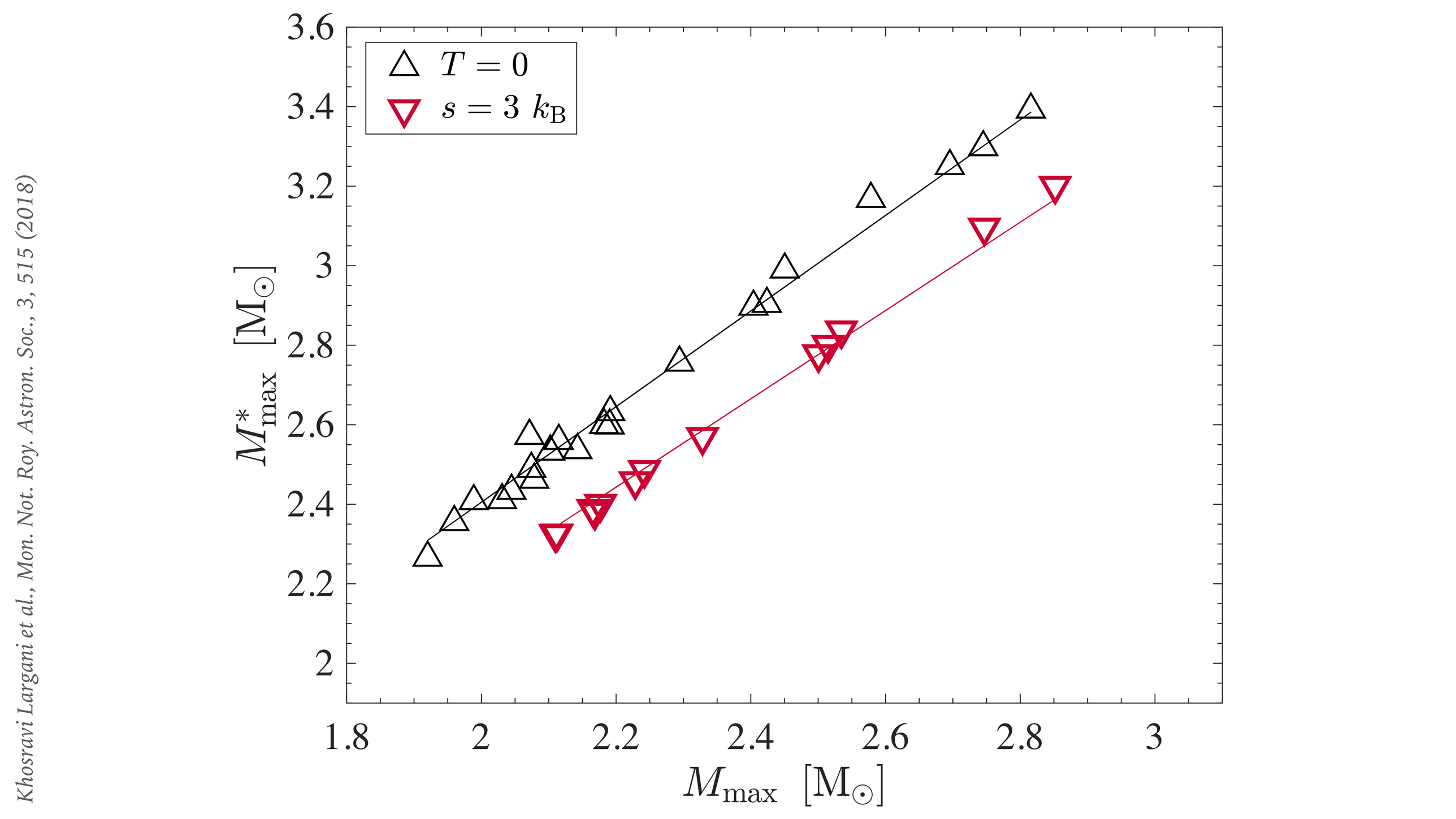


Khosravi Largani et al., APJ, (under revision) (2023)

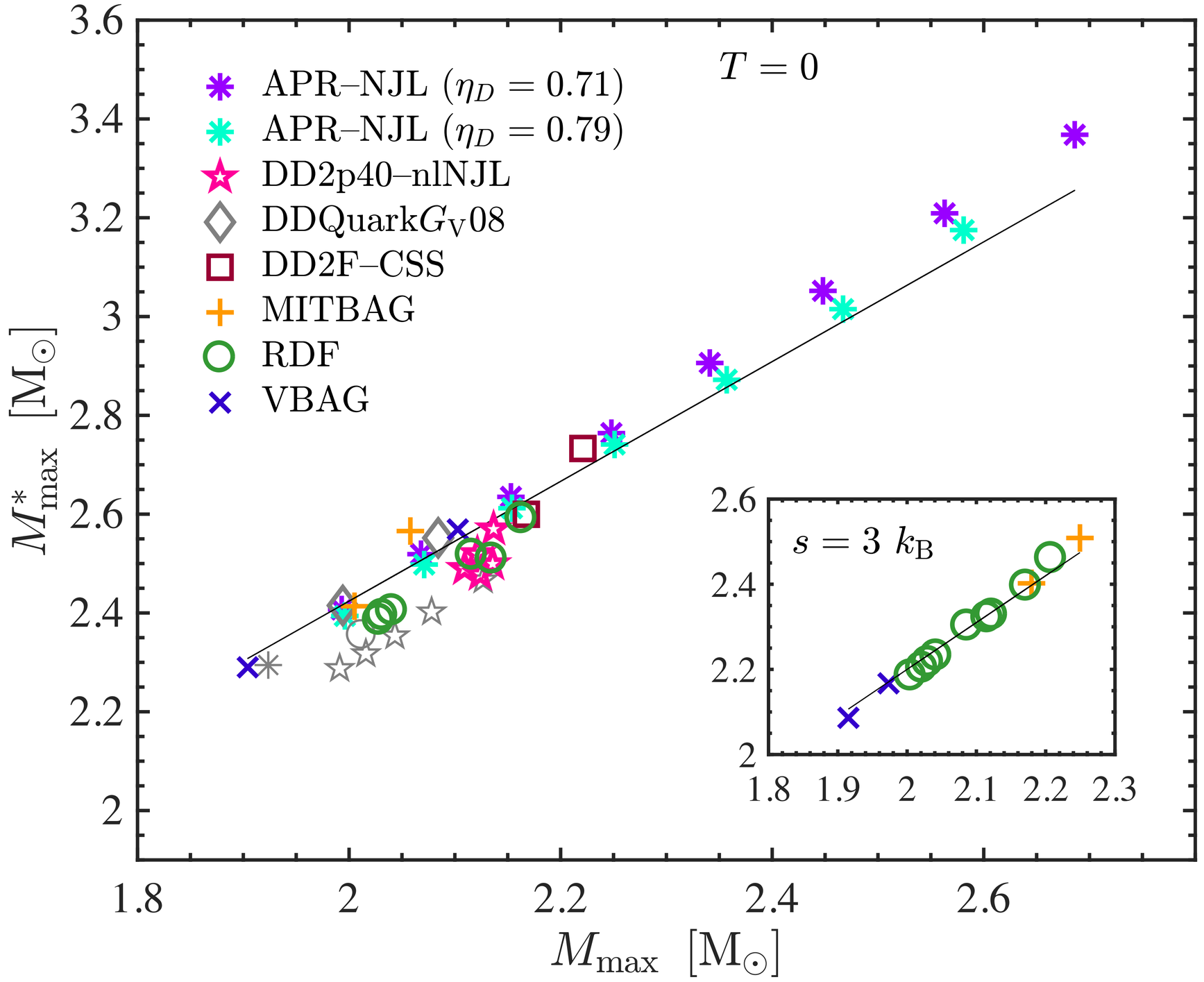


Khosravi Largani et al., APJ, (under revision) (2023)

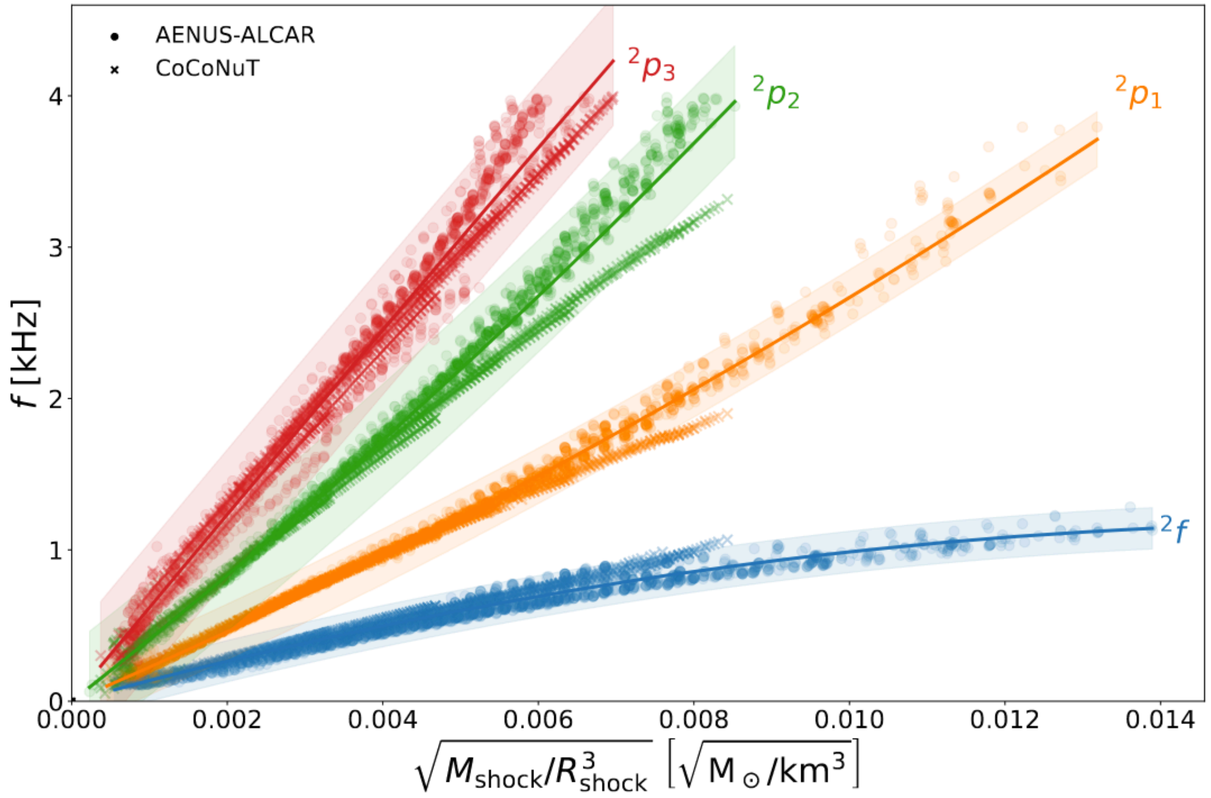

7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
20
25
30
35
40
45
50
55
60
$\rho_{\rm collapse}$ [10^{14} g cm^{-3}]
$\langle E_{\bar{\nu}_e} \rangle$ [MeV]
Preliminary

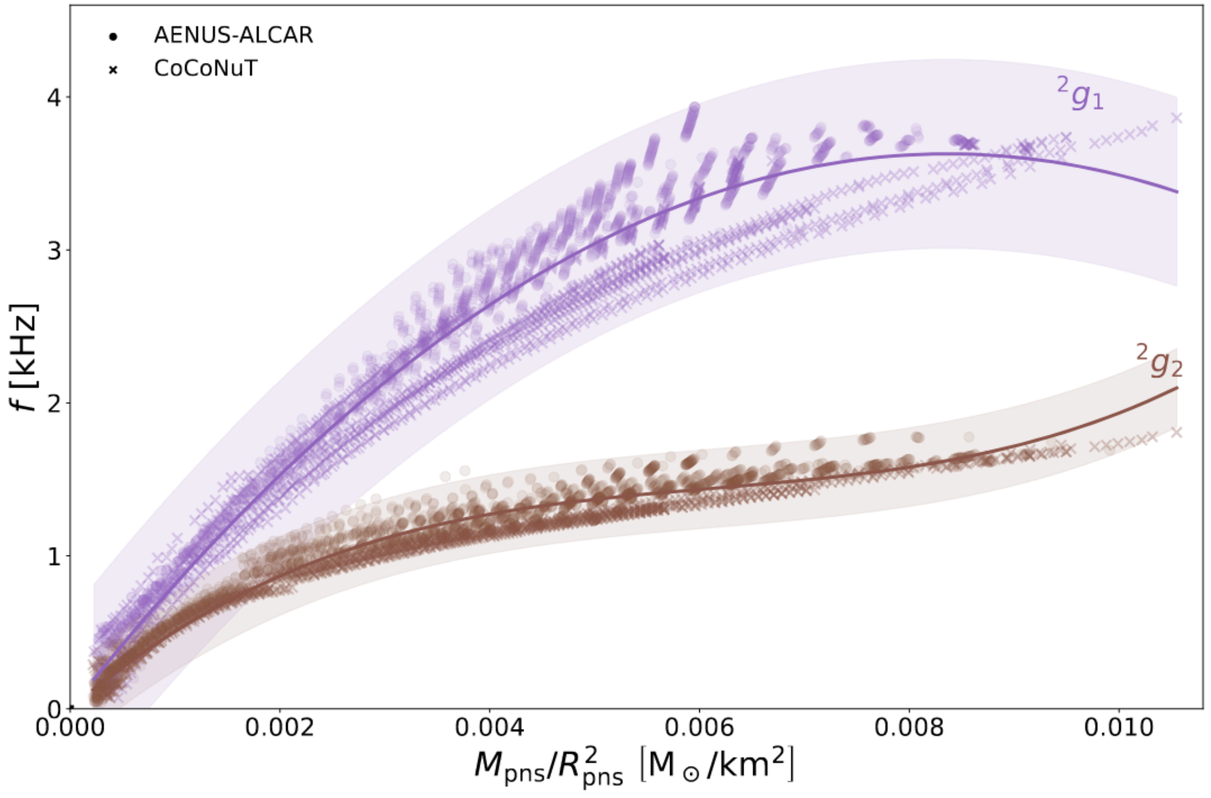


Khosravi Largani et al., Mon. Not. Roy. Astron. Soc., 3, 515 (2018)



Khosravi Largani et al., Mon. Not. Roy. Astron. Soc., 3, 515 (2018)





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