Meeting summary

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University of Glasgow

IGR

University of Glasgow

Stimulating location!

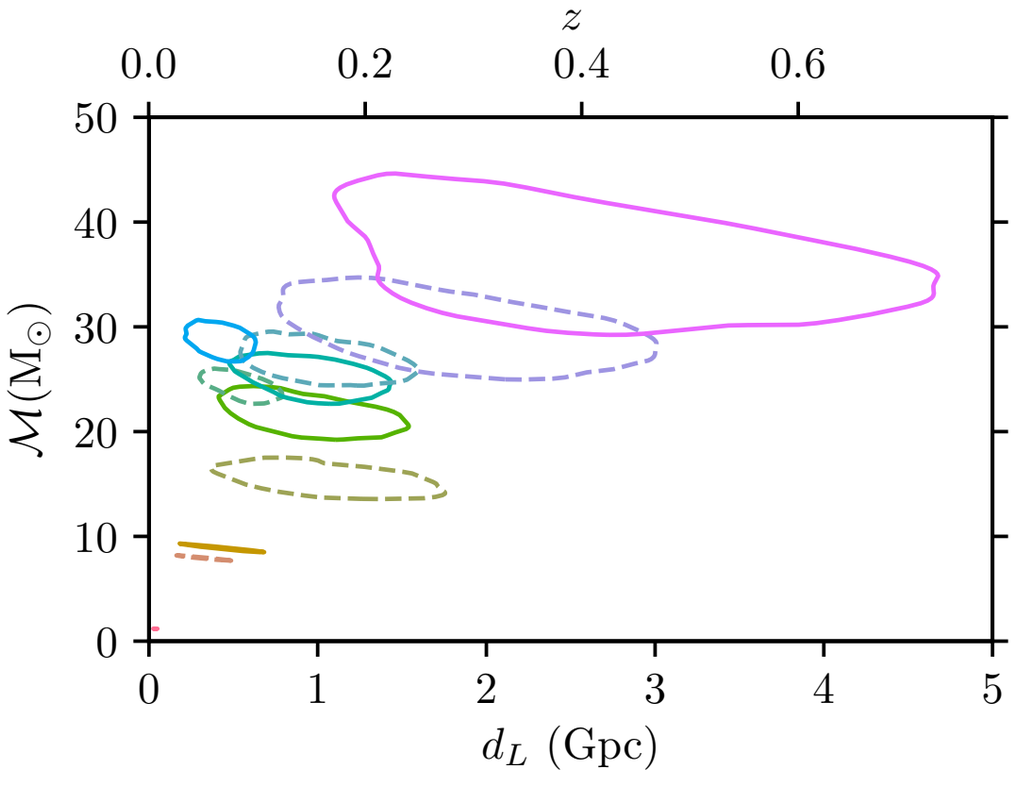
Stimulating meeting!

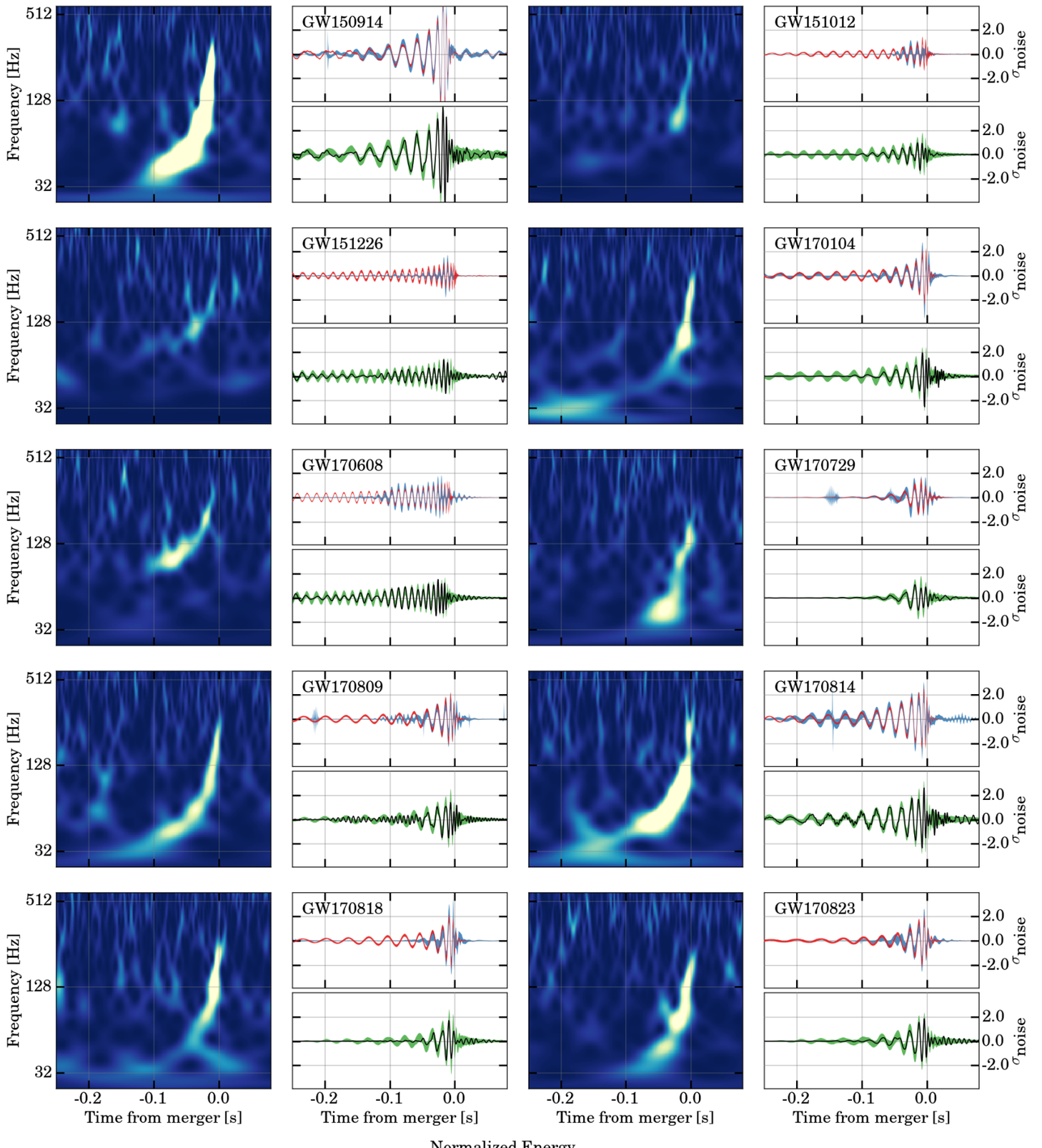
- More than 55 talks, over 150 participants!
- Many thanks to all the hard work from the organisers!

Thank you!!

Catalog of GW detections

- We now have regular GW observations of compact mergers! (Linqing Wen)
- 10 BBH, 1 BNS detected by LIGO-Virgo in O1-O2





Public alerts

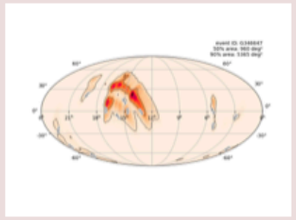
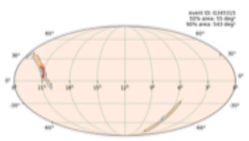
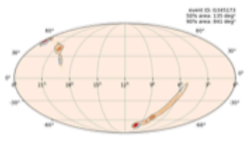
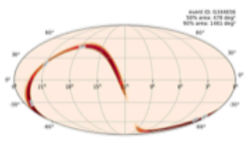
GraceDB — Gravitational-Wave Candidate Event Database

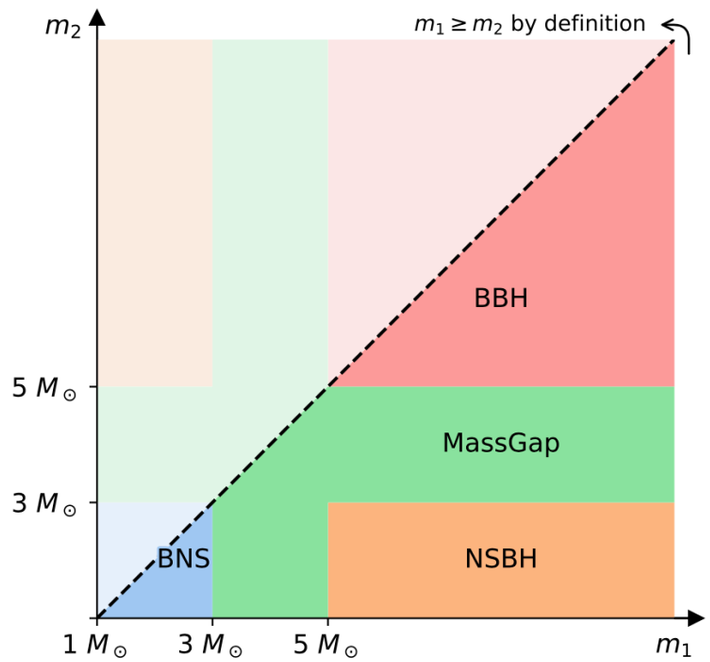
HOME | PUBLIC ALERTS | SEARCH | LATEST | DOCUMENTATION | LOGIN

LIGO/Virgo Public Alerts (https://gracedb.ligo.org)

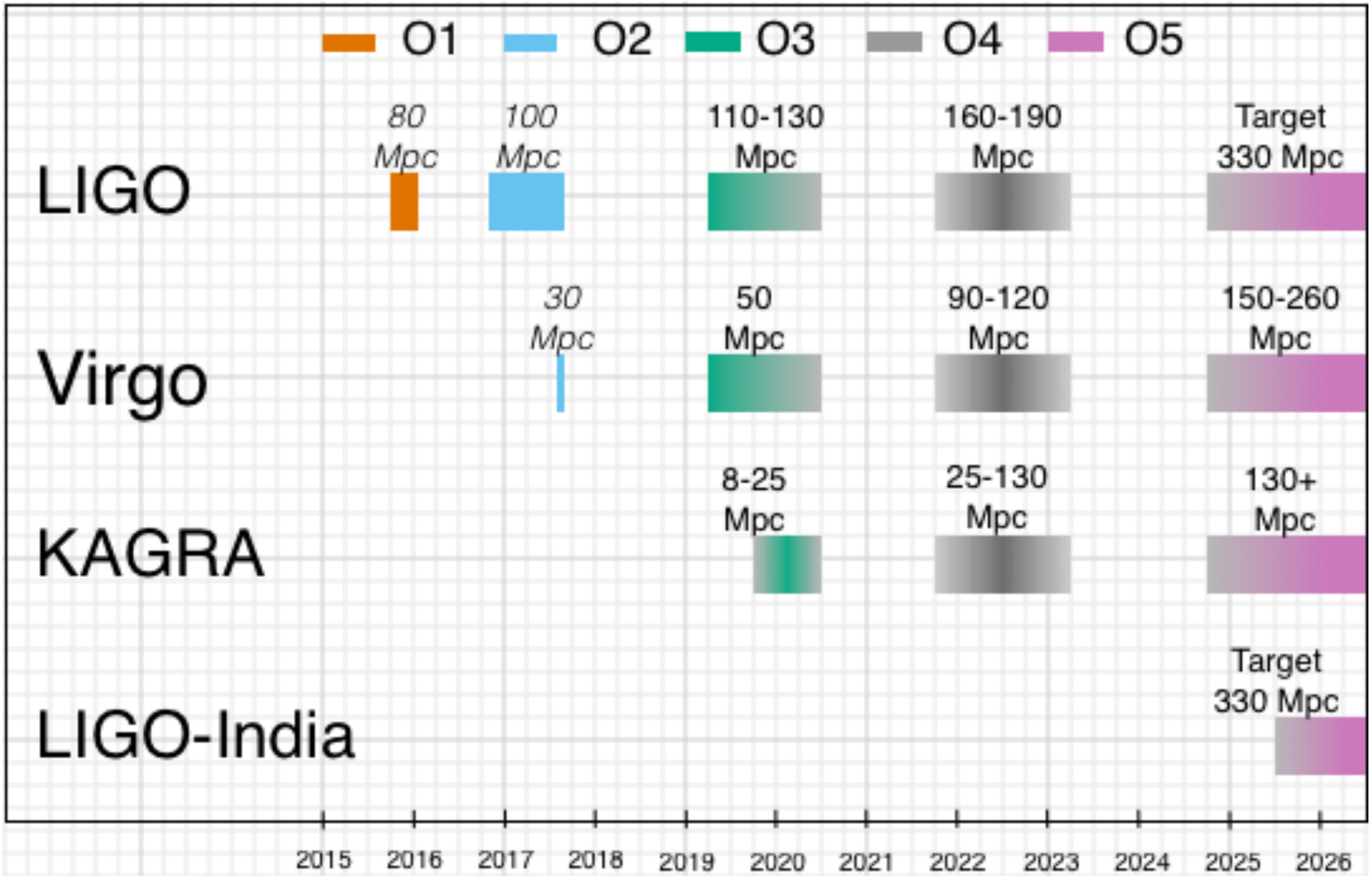
Detection candidates: 22

SORT: EVENT ID (A–Z) ▼

Event ID	Possible Source (Probability)	UTC	GCN	Location	FAR	Comments
S190808ae	Terrestrial (57%), BNS (43%)	Aug. 8, 2019 22:21:21 UTC	GCN Circulars Notices | VOE		1.0622 per year	RETRACTED
S190728q	BBH (95%), MassGap (5%)	July 28, 2019 06:45:10 UTC	GCN Circulars Notices | VOE		1 per 1.2541e+15 years	
S190727h	BBH (92%), Terrestrial (5%), MassGap (3%)	July 27, 2019 06:03:33 UTC	GCN Circulars Notices | VOE		1 per 229.92 years	
S190720a	BBH (99%), Terrestrial (1%)	July 20, 2019 00:08:36 UTC	GCN Circulars Notices | VOE		1 per 8.3367 years	



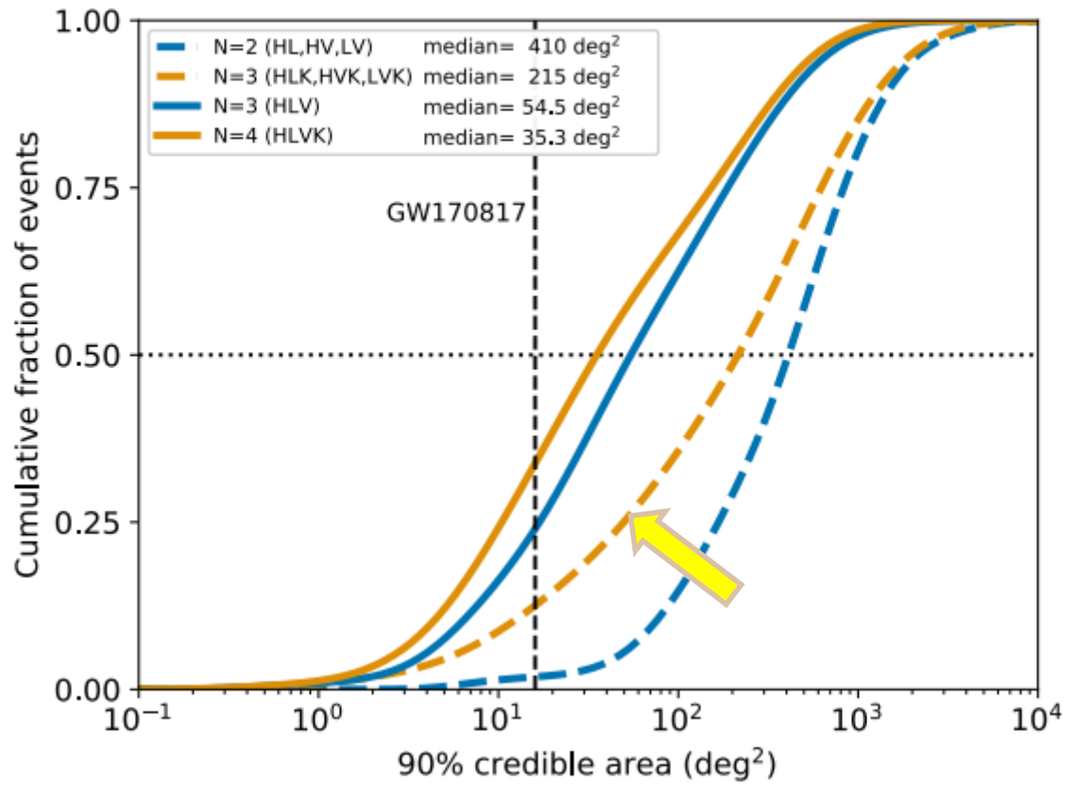
GW observatories



GW observatories

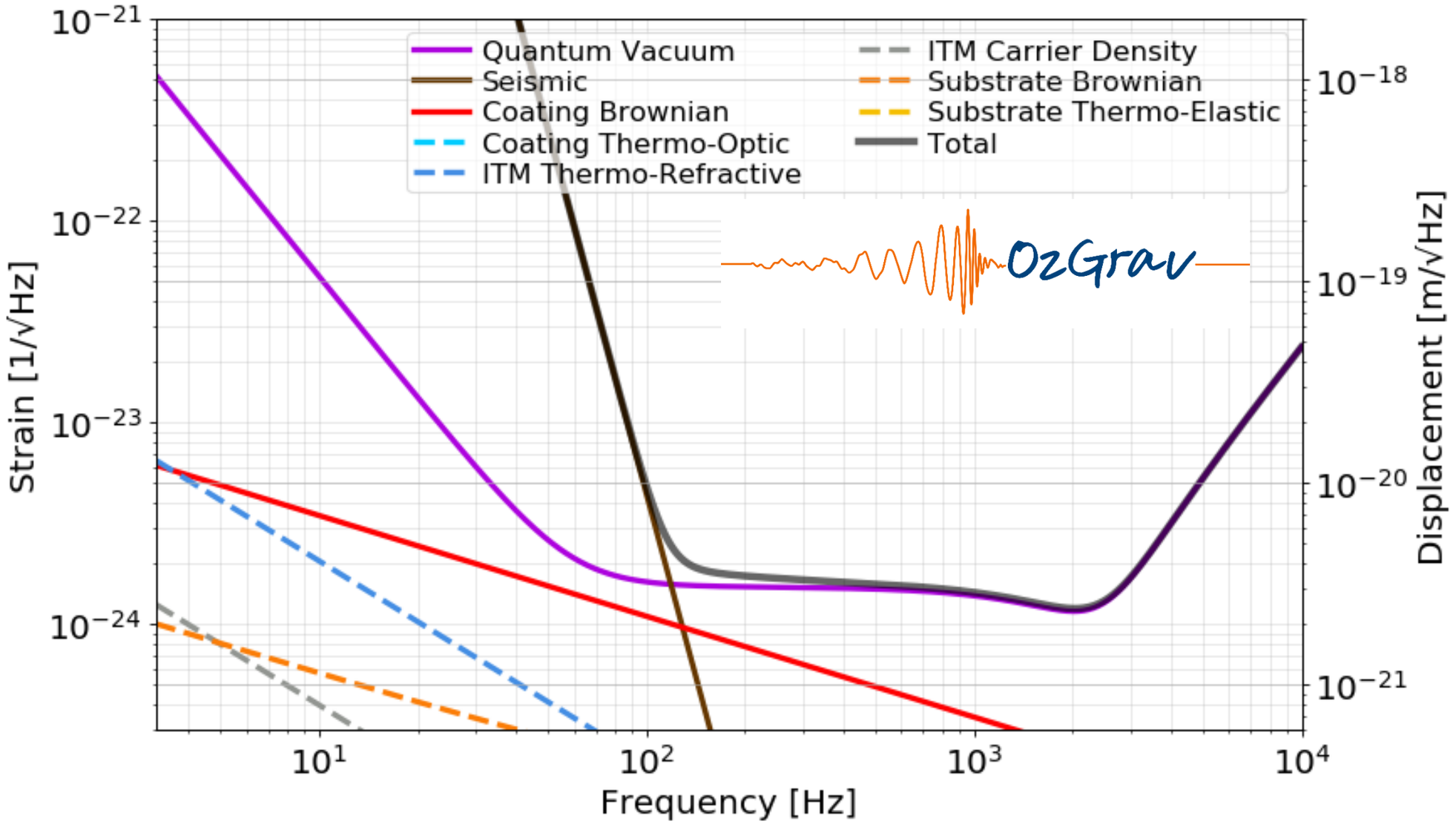
- KAGRA status (Shinji Miyoki)
  - join at end of O3; significant Chinese participation; Kagra will improve sky localisation and network duty cycle
- Earth + Space (Rana Adhikari)
  - space mission in decihertz band can achieve sub 1 deg^2 localisation and can perform full coherent analysis with ground-based detectors
- Taiji Program (Wei-Tou Ni)
  - review of GW spectrum gaps; Taiji update

O3 BNS case assuming KAGRA has 25 Mpc BNS



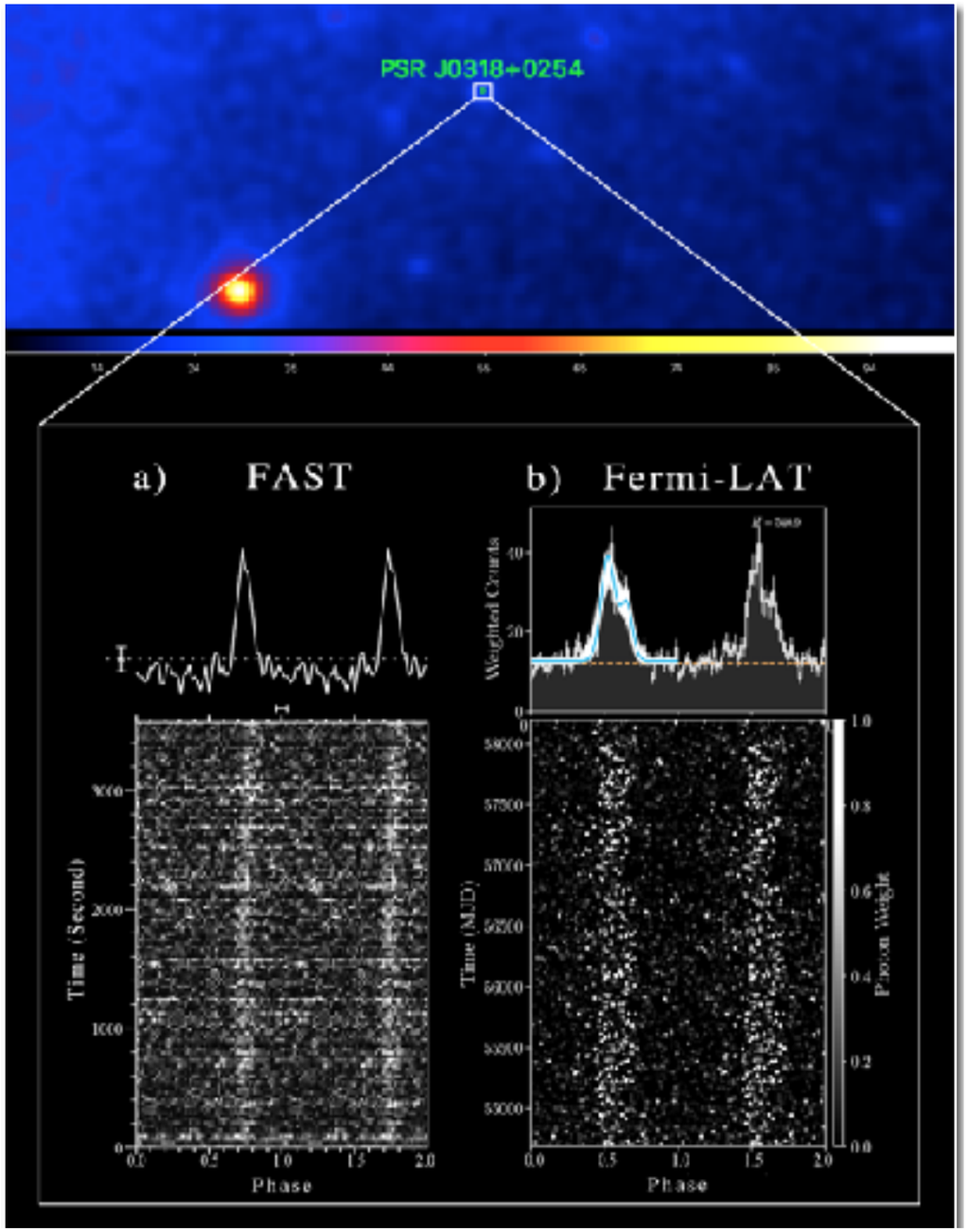
High frequency detectors

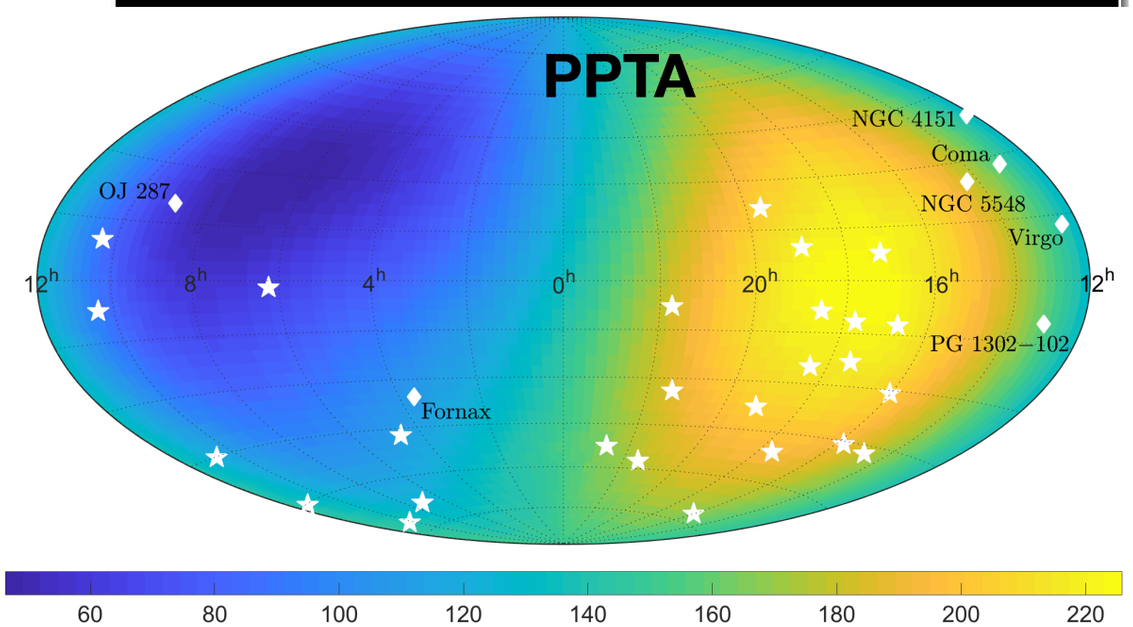
- OzGrav exploring the science case for high-frequency detectors (Matthew Bailes)
  - High frequency detectors to target GWs from BNS postmerger
- Broadband, high-frequency detector using white light cavities based on opto-acoustic interactions; demonstration needed (David Blair)



FAST & Pulsar timing

- FAST confirms 26 MSPs including detection of MSP binary (Di Li)
- FAST progress (Kejia Lee)
  - PTA overview; FAST timing of weak pulsars; Solar system dynamics (no hidden planets);
- SMBH evolution & GW (Qingjuan Yu)
  - estimate of GW signals from SMBH via evolution of BBH formation; BBH rate estimate
- SMBH reverberations (Yu-Yang Songsheng)
  - observed properties of SMBH candidates; MAHA campaign for 50 targets; Mrk6 & Ark120
- Parkes Pulsar Timing Array overview (Xingjiang Zhu)

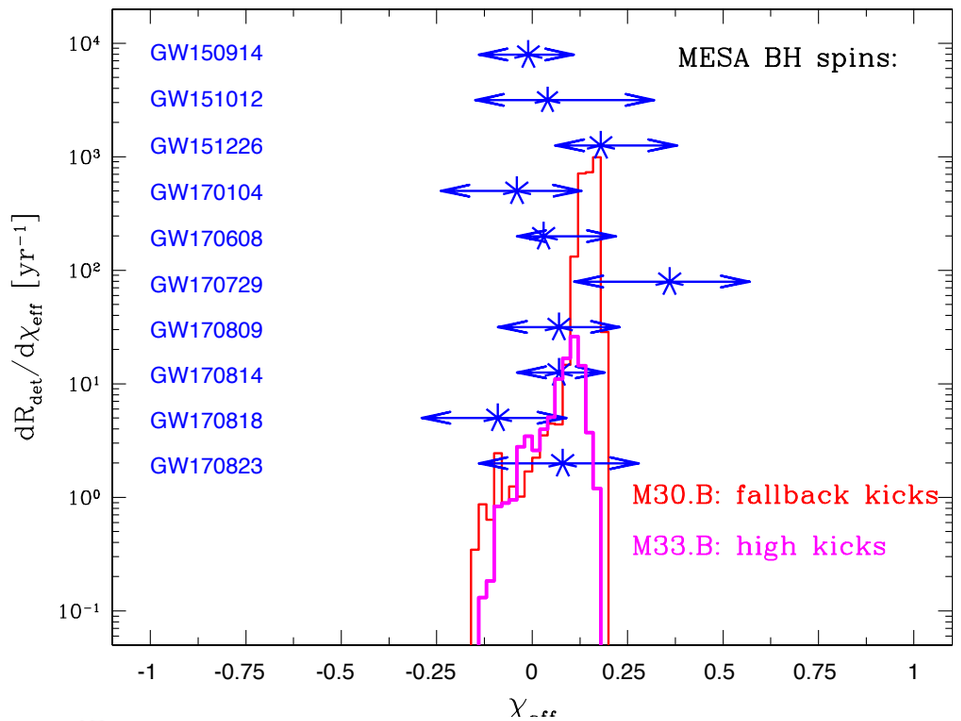


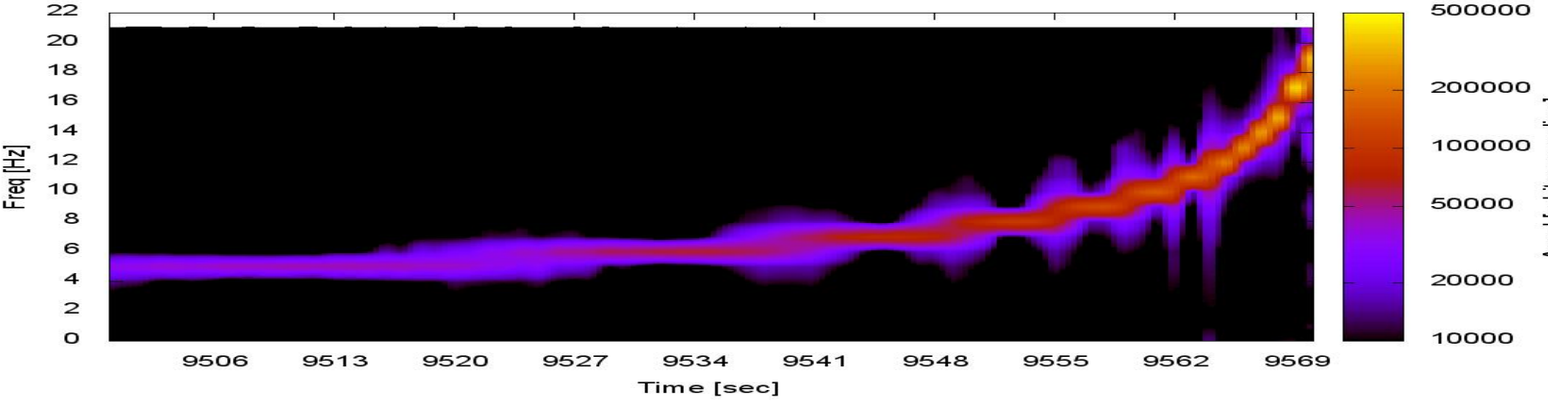


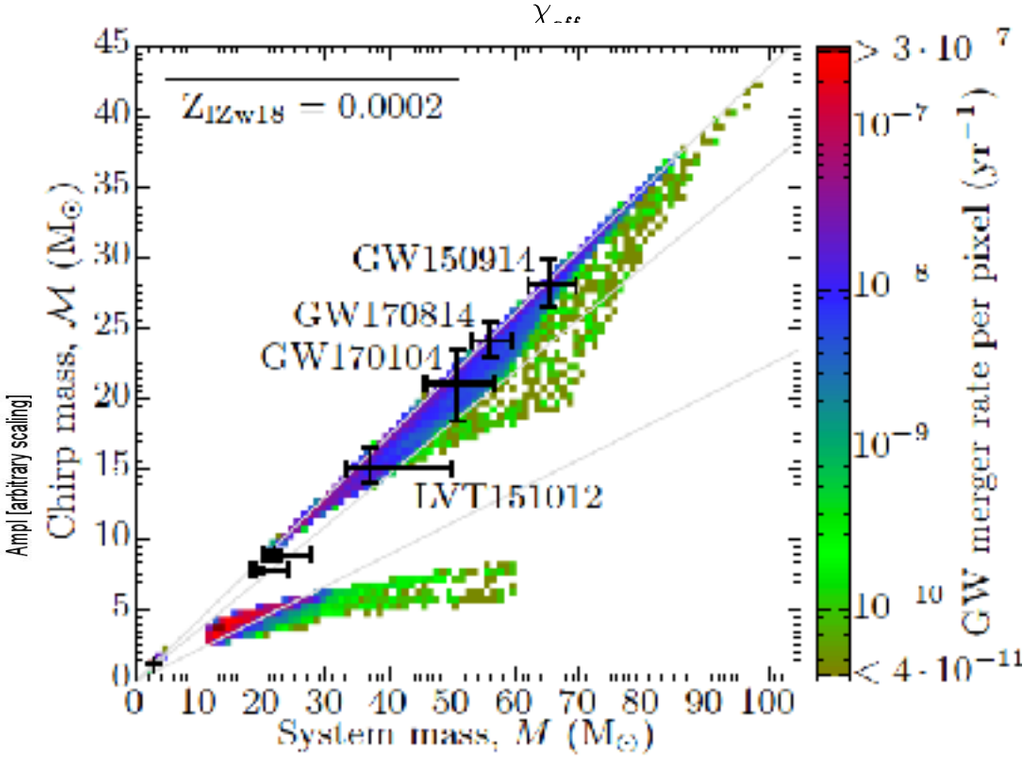
Binary evolution and black hole dynamics

- Formation of double compact binaries (Xiangdong Li)
  - common envelope description; origin of mass gap
- MESA predictions consistent with BBH spins (Krzysztof Belczynski)
- LIGO-Virgo detections reproduced for varying progenitor metallicities (Matthais Kruckow)
- Search for black holes with supercomputers (Rainer Spurzam)

MESA model

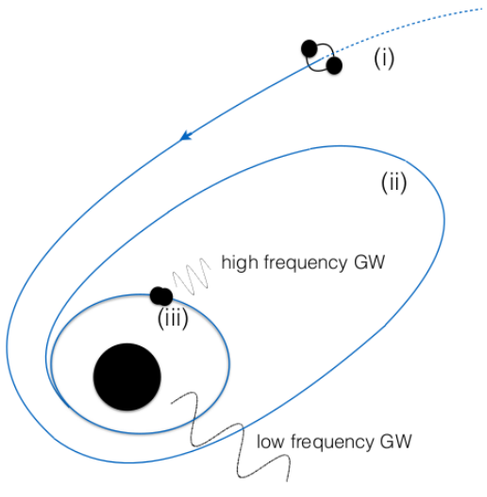


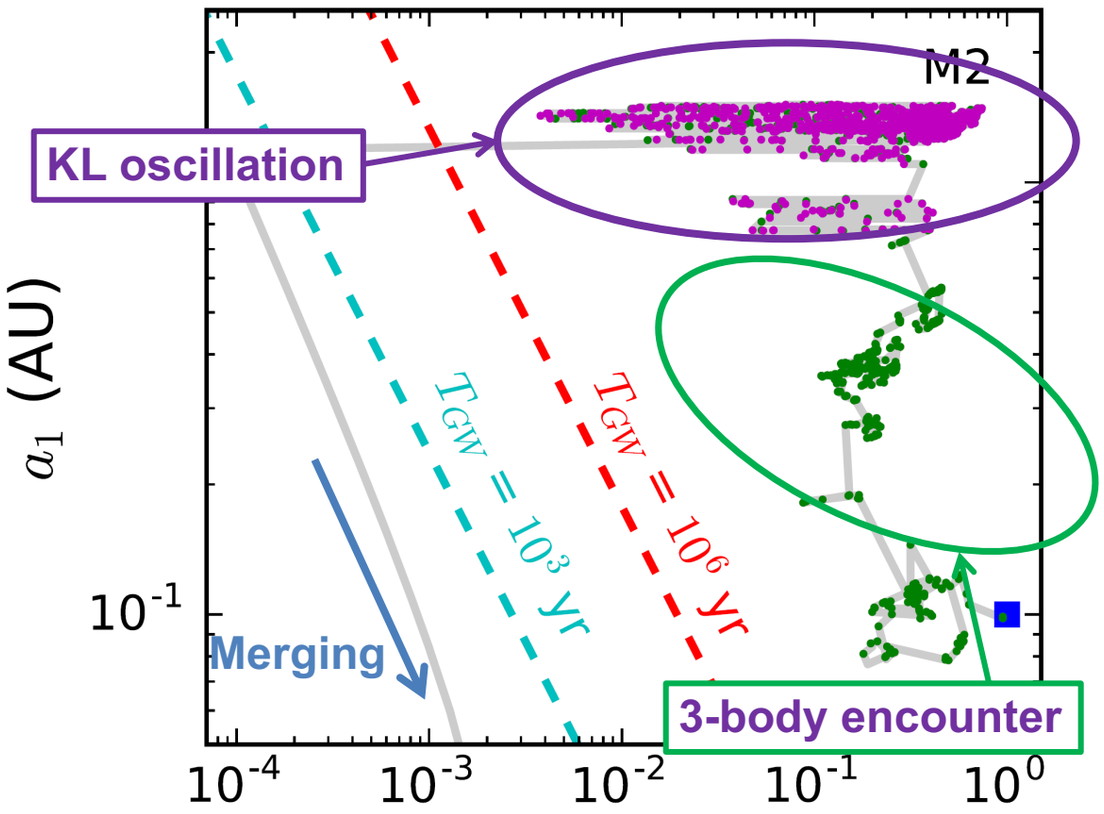




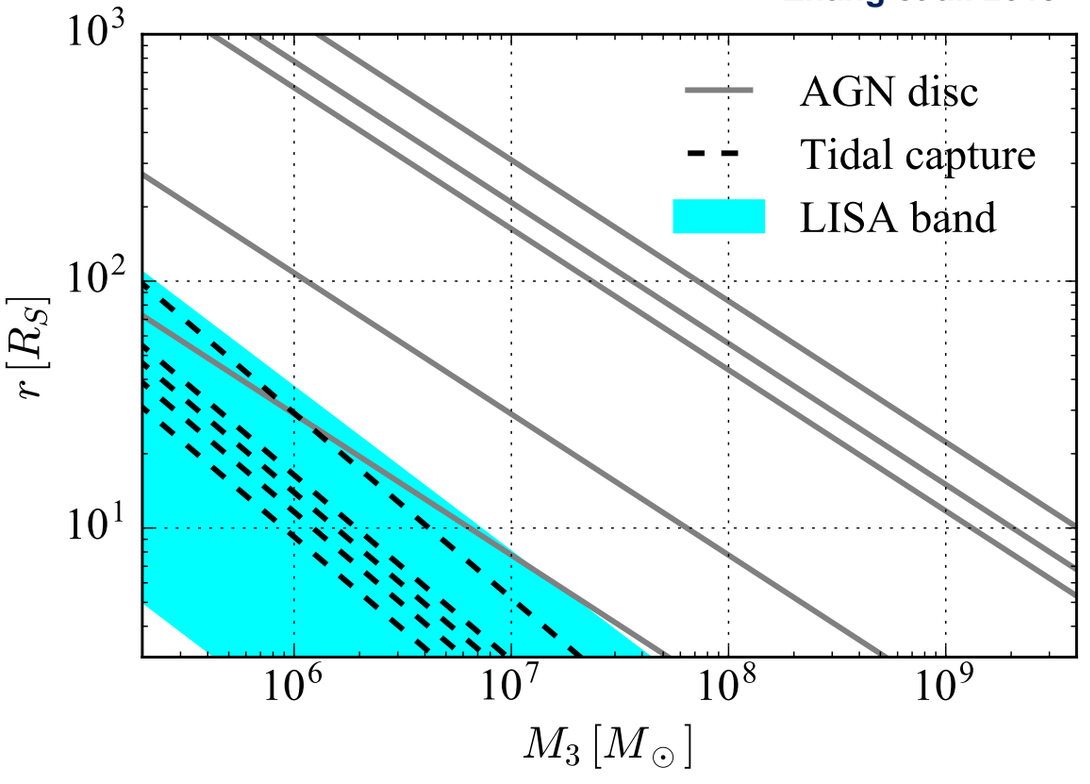
Black hole astrophysics

- WD-IMBH (EMRI) with possible EM transients (Rong-Feng Shen)
- Modelling BBH around SMBH (Fupeng Zhang)
- Distortion of GW signals in astro environments (Xian Chen)
  - BBH in AGNs; low event rate for tidal capture model; observed BH mass affected by environment?
- No EM counterparts from BBH mergers: Frozen star hypothesis rejected (Shuang-Nan Zhang)
- X-ray flares up to 10^{48} erg/s associated with EMRI (Fayin Wang)



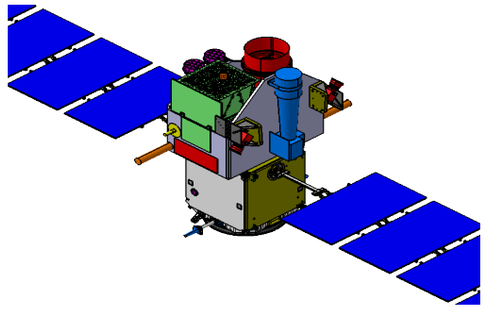


Zhang et al. 2019

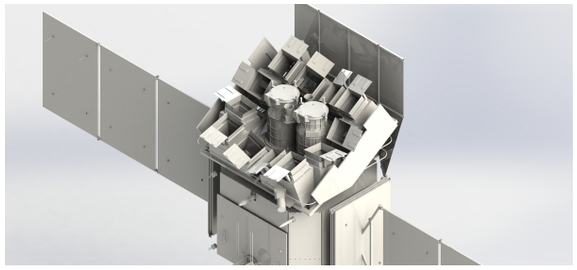


Synergy in the GW-EM era in China

GECAM, 2020-



SVOM, 2021-



Einstein Probe, 2022-

Photometric Survey Telescopes

2021–2025

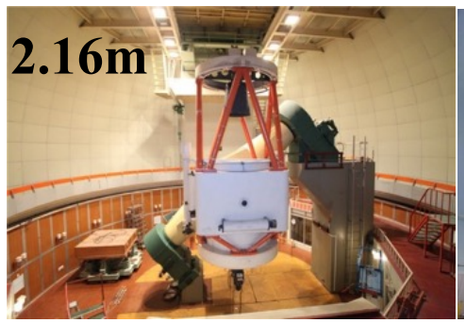
USTC-PMO 2.5m WFST @ Lenghu
YNU 1.6m Mephisto @ Lijiang
BNU1.9m @ Muztagh

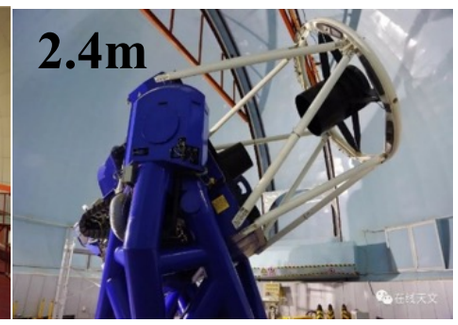
2025–2035

Sitian Project (proposed)

Spectroscopic Telescopes

2m class





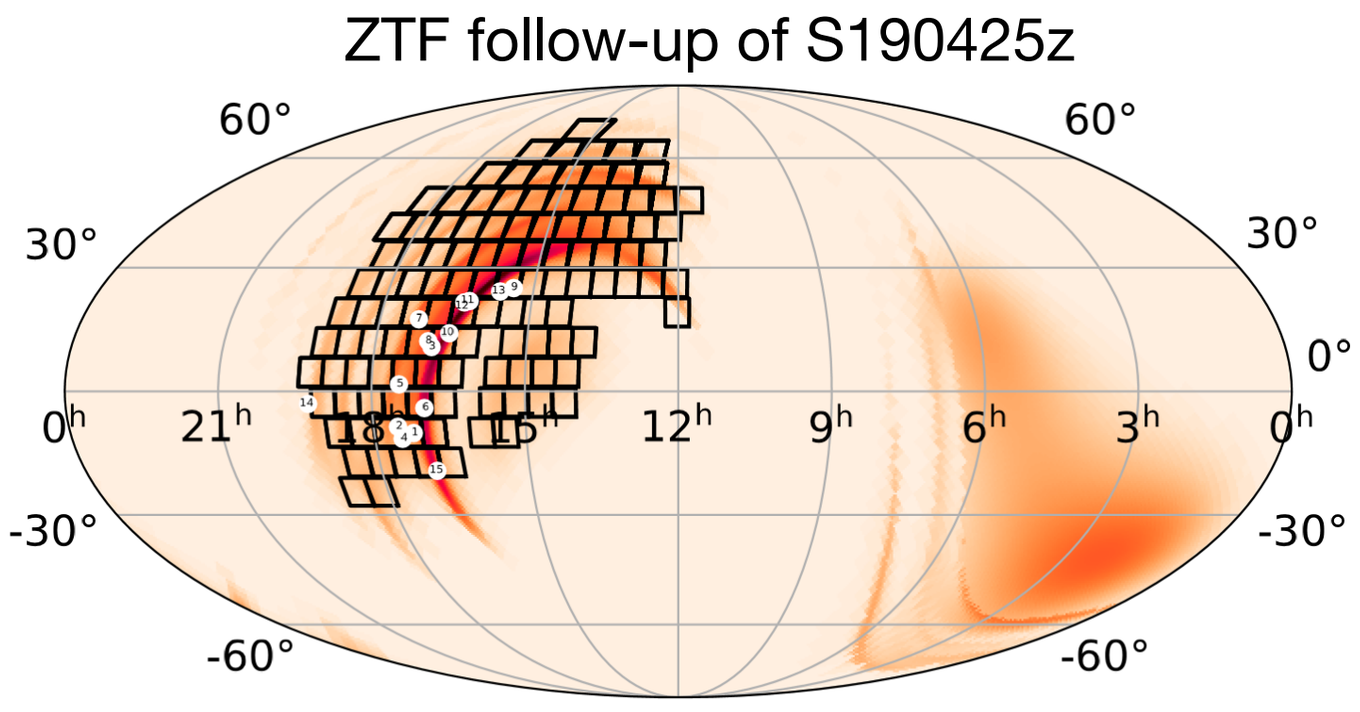
4m class

Sitian Project (proposed, 2025-2035)

10m class

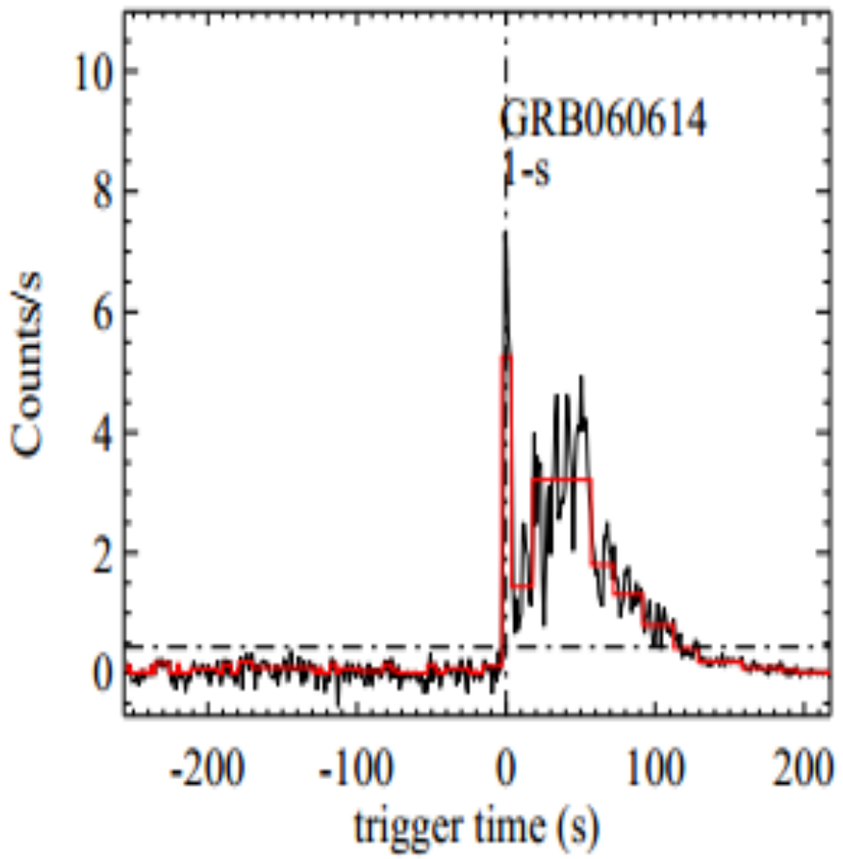
Multi-messenger astrophysics

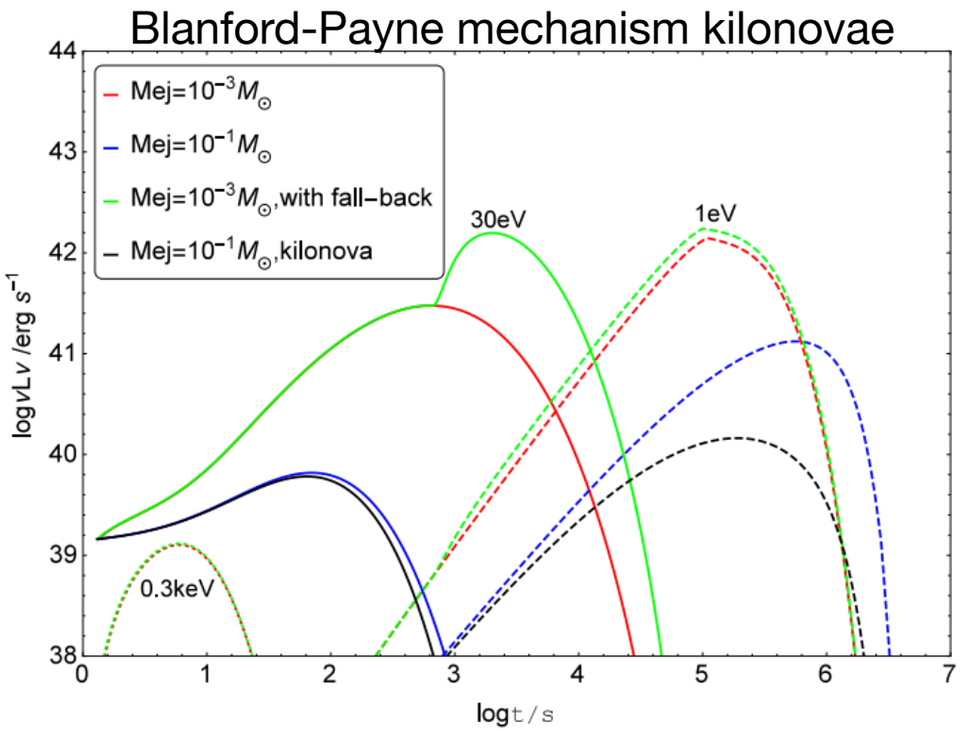
- EM counterparts of GWs (Bing Zhang):
  - HMNS/BH:SMNS:SNS -> (0.32-0.67) : (0.18-0.68) : (<0.03)
  - Rate inconsistency? Not all BNS mergers lead to short GRBs?
  - charged CBC as EM source
- Overview of GW sources with EM signals; follow-up of more distant BNS mergers challenging (Eric Burns)
- Long GRB light curves indicate transition from EM to GW dominated regimes -> evidence for magnetars (En-Wei Liang)



Multi-messenger astrophysics

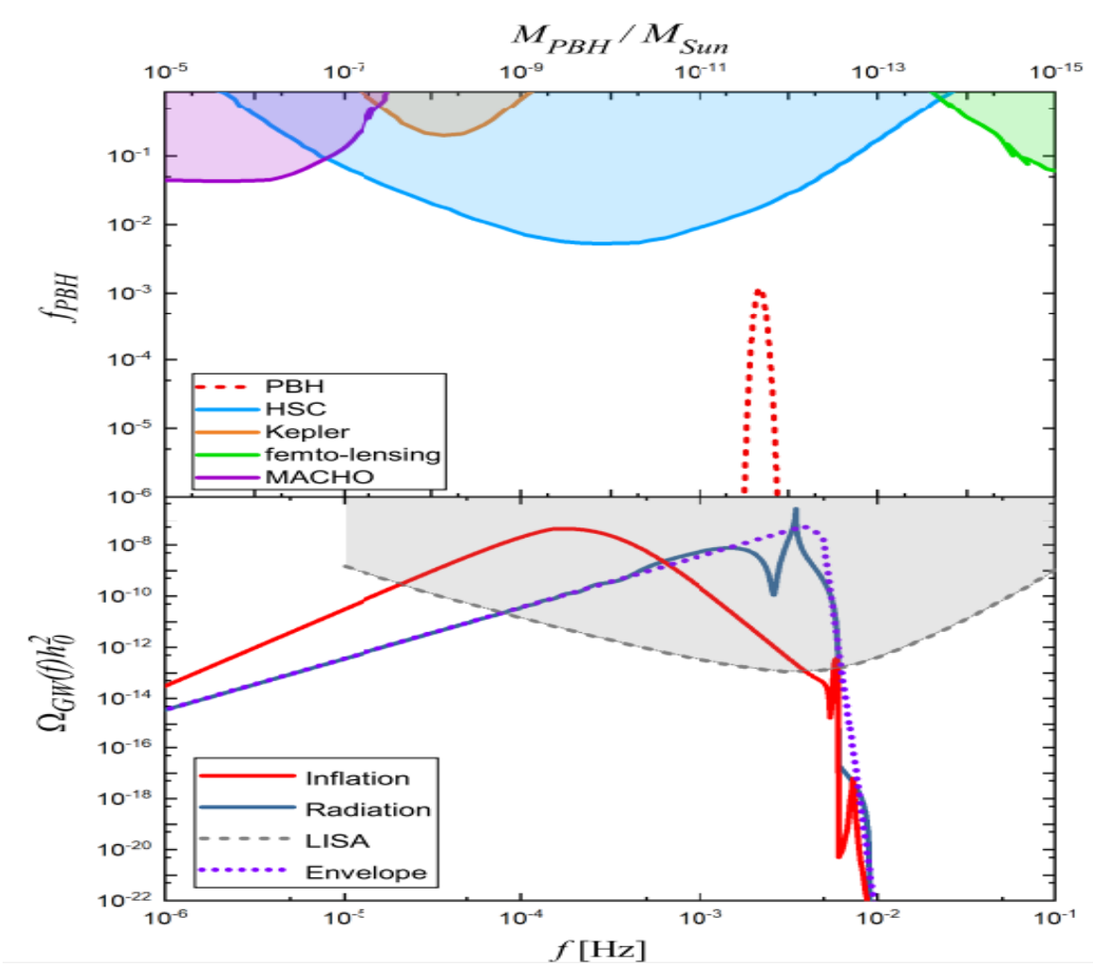
- Analysis of 26 short GRBs with extended emission found that such emissions are softer than hard spike (Hou-Jun Lu)
- Estimated luminosity of nearby short GRBs (<200 Mpc) is around 10^{46}-10^{47} ergs (Daming Wei)
- GRBs are powered by Blanford-Znajek and Blanford-Payne (BP) mechanisms; kilonovae are enhanced by BP wind injections (Weihua Lei)
- Neutrinos! (Donglain Xu)

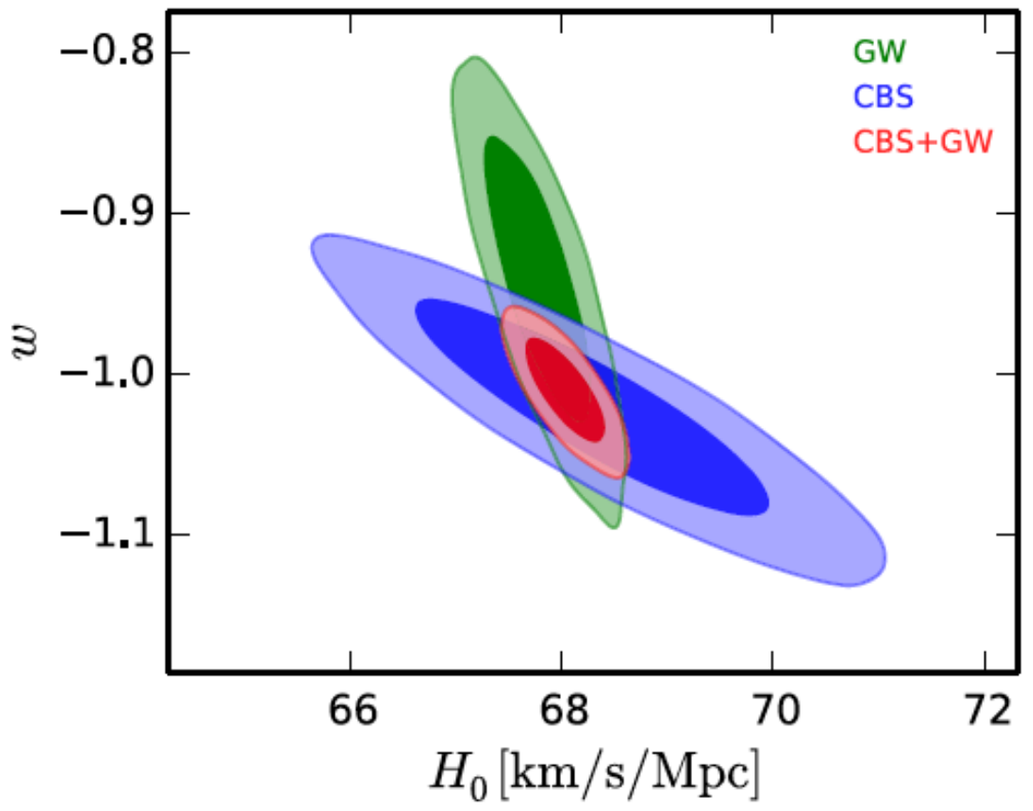




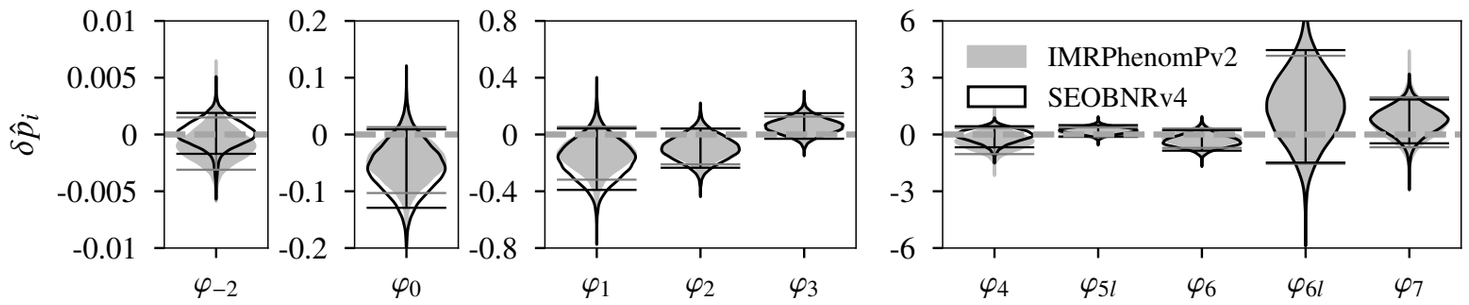
Cosmology

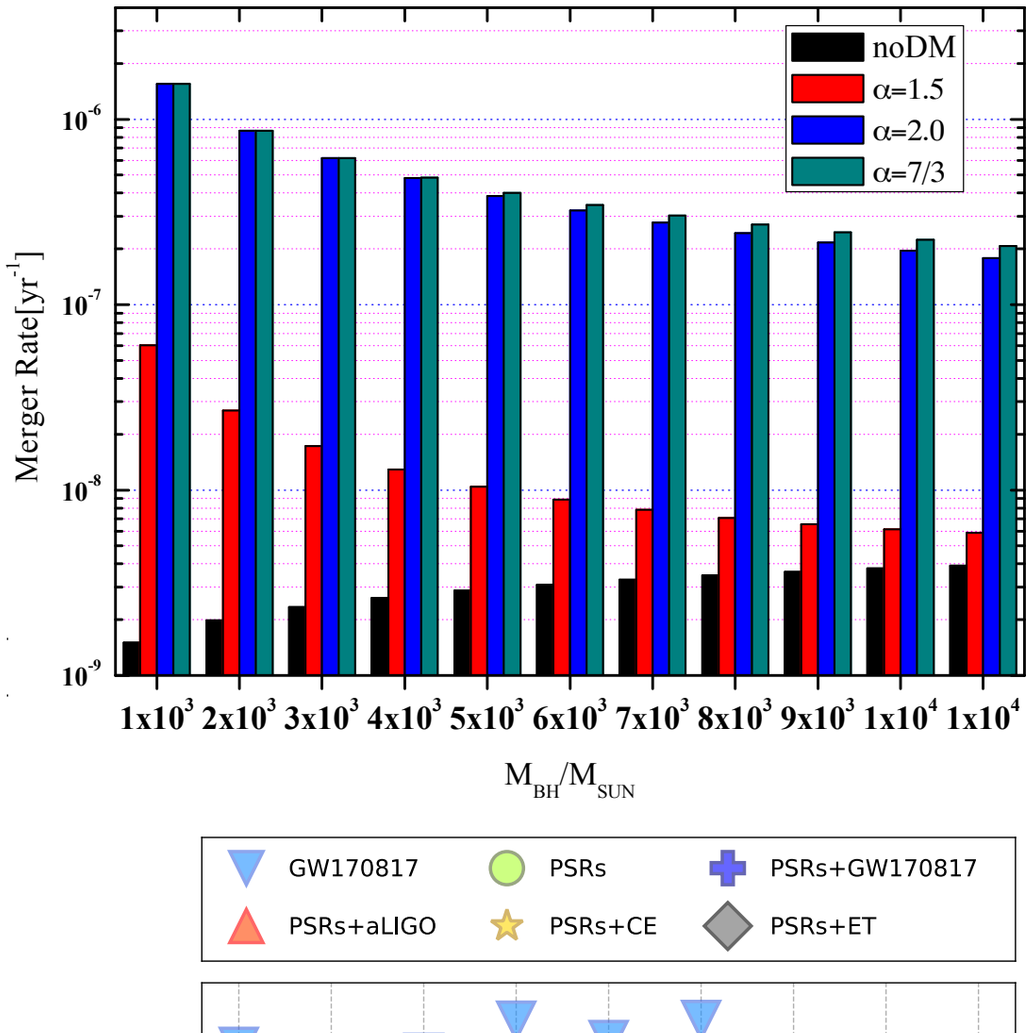
- Sound speed resonance in power spectrum can induce GW emissions from PBHs (Yifu Cai)
- GW H_0 measurements break degeneracy; GW can improve neutrino mass constraint by 10% (Xin Zhang)
- 10 lensed GW+EM observations can constrain cosmological parameters as well as 300 lensed quasars (Yufeng Li)
- GW+FRB as standard sirens since product of luminosity distance and dispersion measure is independent of H_0 (Jun-Jie Wei)





Testing GR





- Testing GR with LIGO-Virgo detections (Yanbei Chen)
- Test GR with binary pulsars & EOS (Matthew Bailes)
- ET could test parity symmetry of gravity (Wen Zhao)
- propose searching for tensorial GWs by looking at rotation of polarisation for lensed events (Xilong Fan)
- Dark matter & ECO effects on GW observations in LISA (Wenbiao Han)
- Combine binary pulsars observations with GW170817 to test scalar tensor gravity (Junjie Zhao)