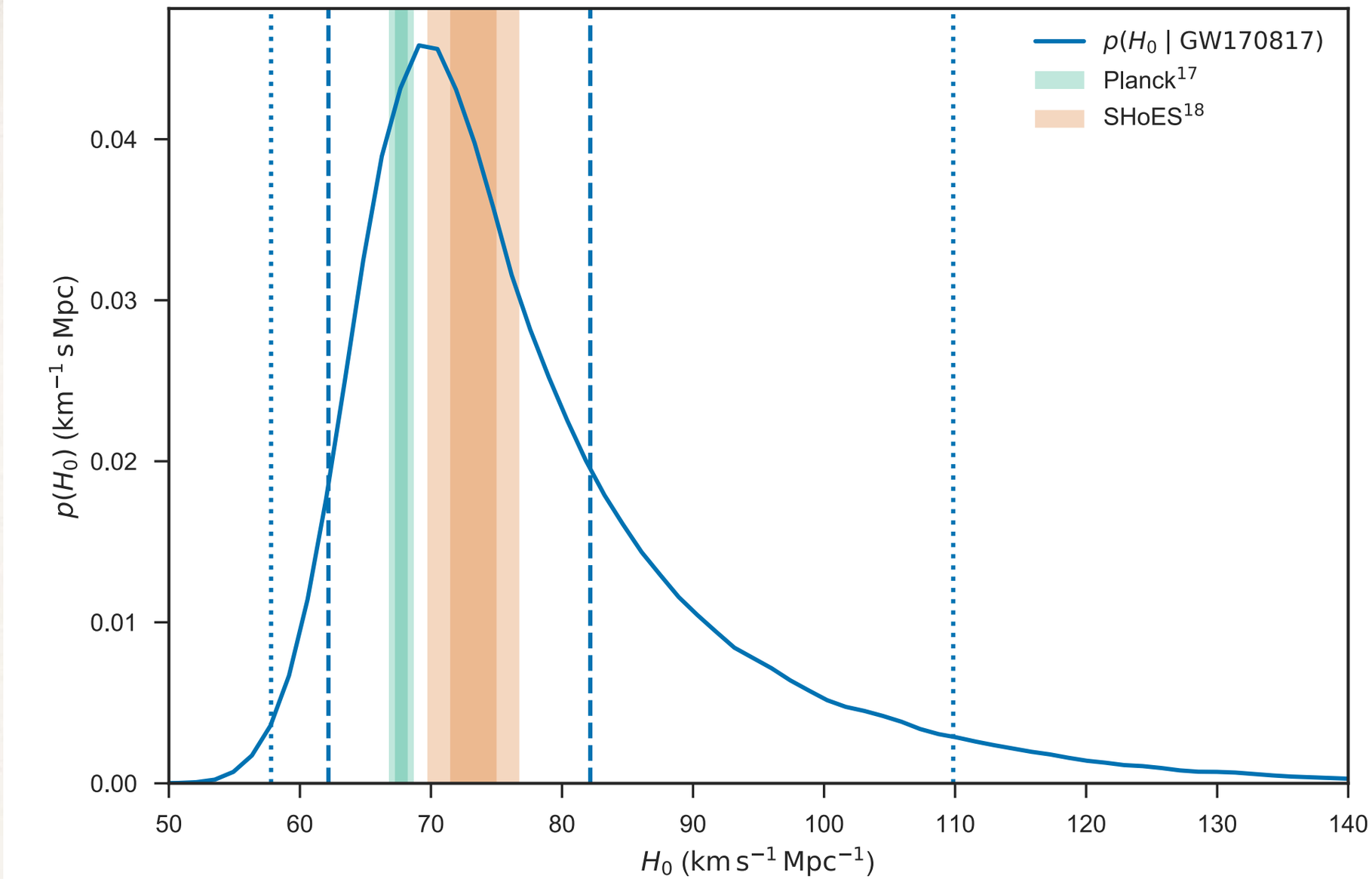


Abbott et al. (2017)

Precision standard siren cosmology

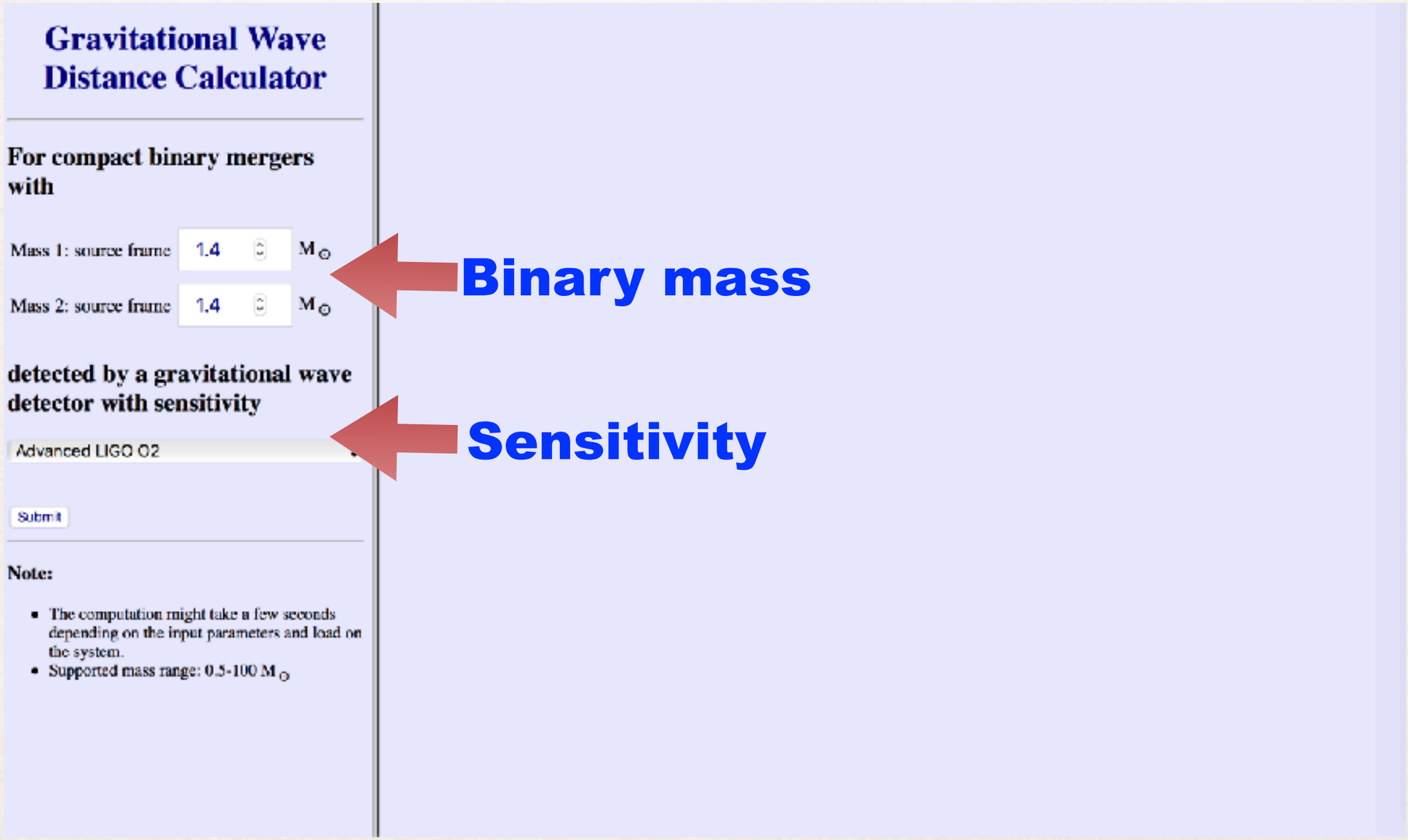
Hsin-Yu Chen (Black Hole Initiative Fellow, Harvard University)

LV-EM Town Hall Meeting, March 2018

Chen et al. , arXiv 1709.08079

Gravitational-wave distance calculator

http://gwc.rcc.uchicago.edu



Chen et al. , arXiv 1709.08079

Gravitational-wave distance calculator

http://gwc.rcc.uchicago.edu

Gravitational Wave Distance Calculator

For compact binary mergers with

Mass 1: source frame: 1.4 $M_\odot$

Mass 2: source frame: 1.4 $M_\odot$

detected by a gravitational wave detector with sensitivity

Advanced LIGO O2

Submit

Note:

- The computation might take a few seconds depending on the input parameters and load on the system.
- Supported mass range: 0.5-100 $M_\odot$

See Chen, Holz, et al. (2017) for a discussion of these quantities

Results:

Distance measure		Description	Redshift	Luminosity distance (Mpc)
Reach 50	$d^{\rm r}_{50}$	50% of all detected sources lie within this distance	0.018	81.7
Reach 90	$d^{\rm r}_{90}$	90% of all detected sources lie within this distance	0.029	132.9
Horizon	$d^{\rm h}$	the farthest a source could be detected above threshold	0.041	188.9
Response 50	$d^{\rm p}_{50}$	50% of sources at exactly this distance are detected	0.013	60.1
Response 10	$d^{\rm p}_{10}$	10% of sources at exactly this distance are detected	0.026	114.8
SFR Reach 50	$d^{\rm SFR}_{50}$	50% of all detected sources lie within this distance (source rate follows SFR)	0.018	82.6
SFR Reach 90	$d^{\rm SFR}_{90}$	90% of all detected sources lie within this distance (source rate follows SFR)	0.030	133.9
Average	$\bar{d}$	average distance of all detected sources	0.019	84.2
SFR Average	$\bar{d}^{\rm SFR}$	average distance of all detected sources (source rate follows SFR)	0.019	84.9

Range	R	radius of a Euclidean sphere with same sensitive redshifted volume	79.8 Mpc
Redshifted Volume	V_z	the sensitive volume of the search	0.0021 Gpc^3

Chen et al. , arXiv 1709.08079

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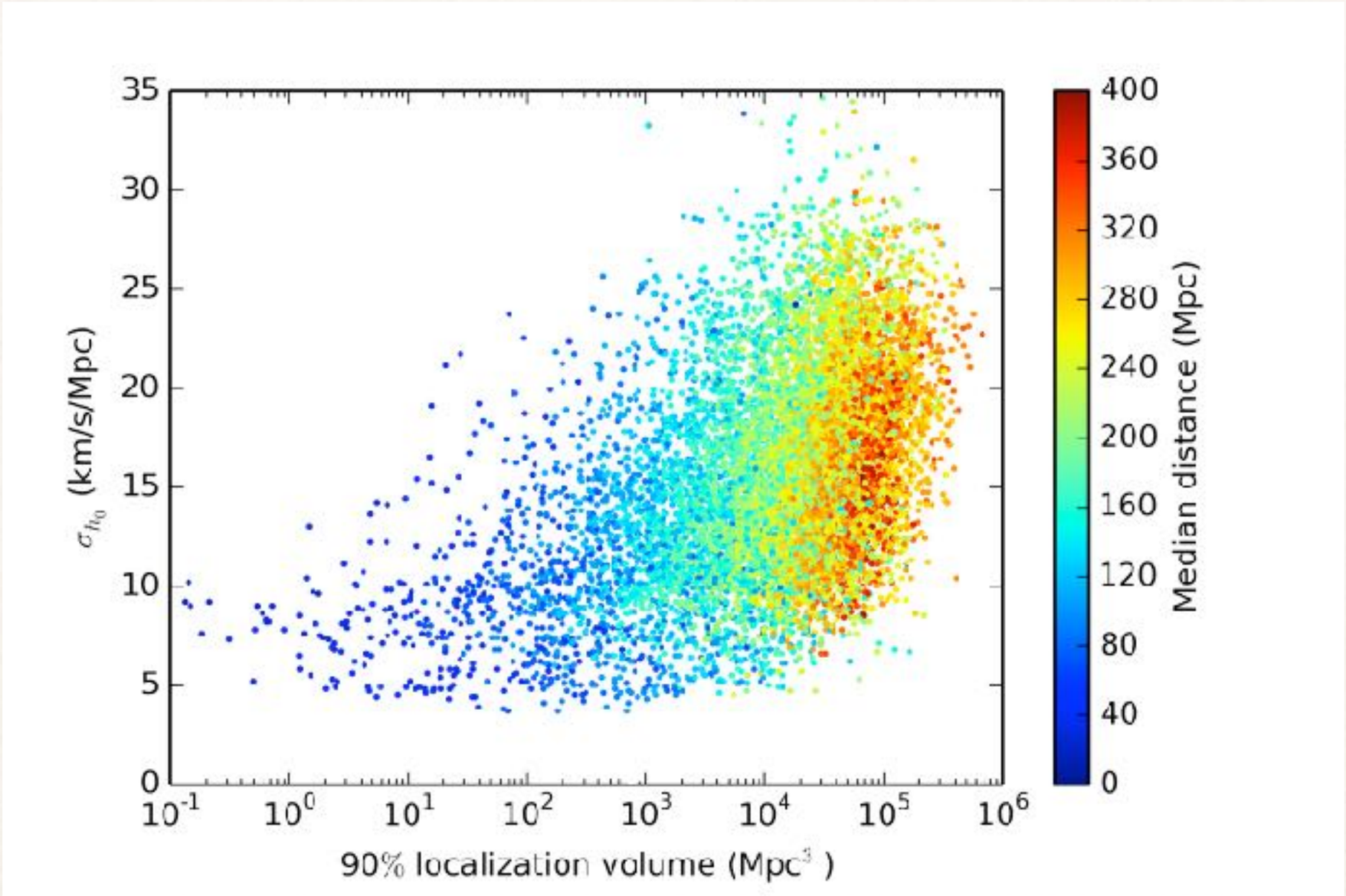
How well can we constrain H0, and what is the follow-up strategy?

Chen et al. , arXiv 1712.06531

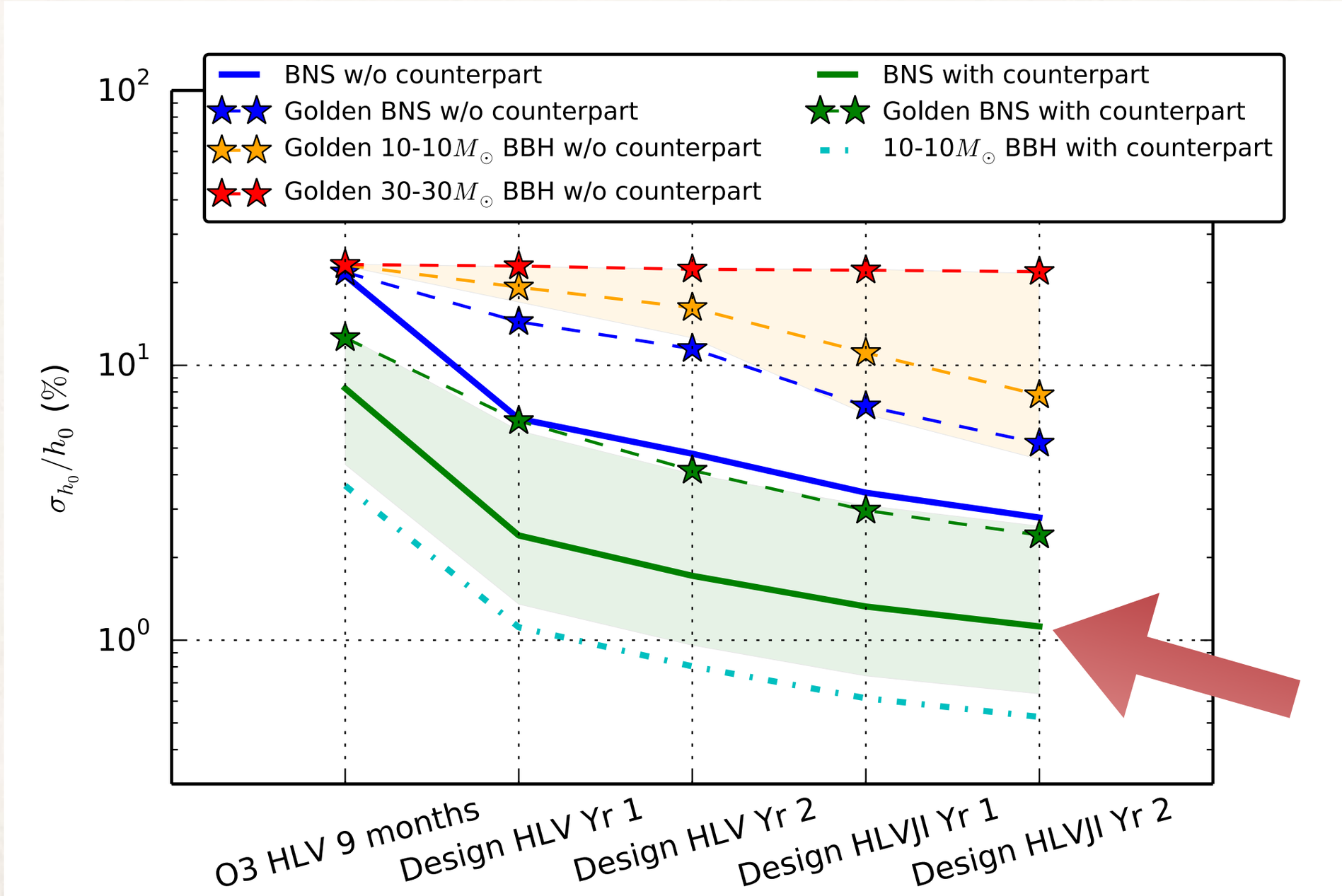
Large scale simulations



Binary neutron star mergers, HLV design

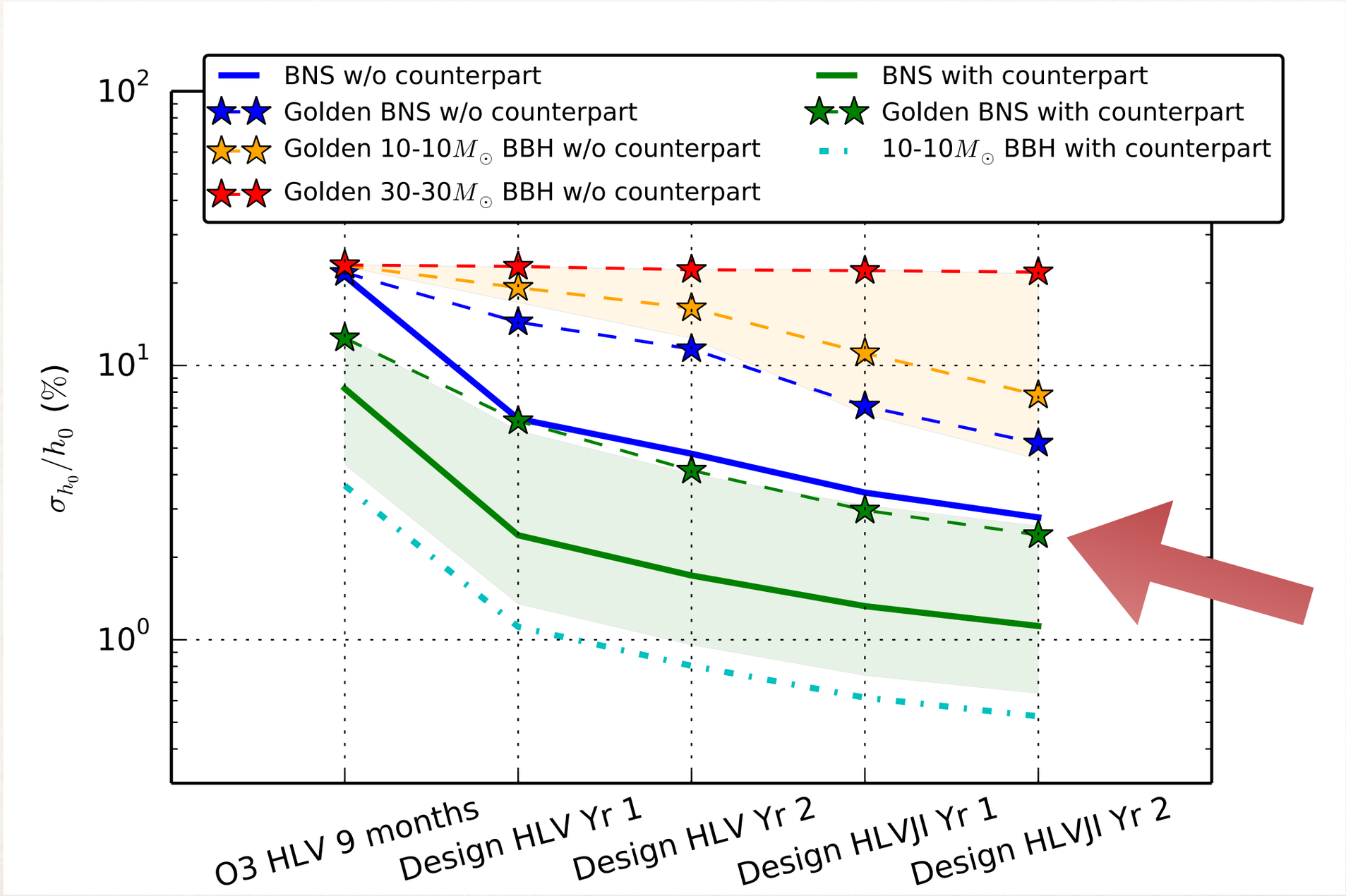
Chen et al. , arXiv 1712.06531

3% uncertainty by the end of the second year HLV design sensitivity



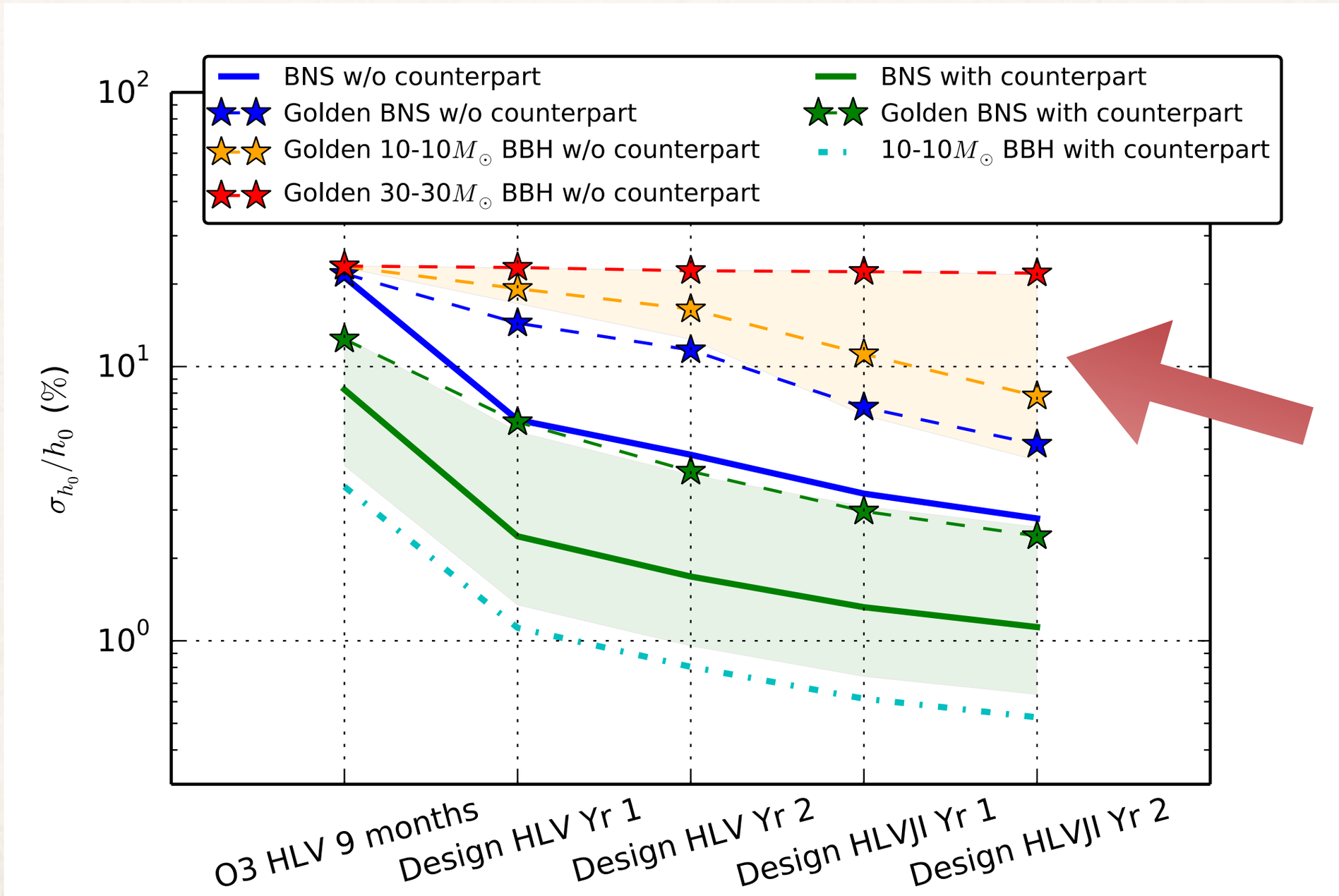
Chen et al. , arXiv 1712.06531

A factor of 2 less precise if using only 10% of the (golden) events



Chen et al. , arXiv 1712.06531

Events without counterparts can hardly provide competitive constraint using galaxy catalogs



Chen et al. , arXiv 1712.06531

Large Scale Structure