Status of KAGRA Stochastic Background

Guo Chin Liu

Summary of Research Units

1. Mitsuru Kakizaki

a. spectrum of primordial gravitational waves from the bubble dynamics beyond standard model 2. Shinya Kanemura:

a. Probing cosmic phase transitions through Stochastic gravitational waves

3. Hyung Won Lee:

a. primordial gravitational wave spectrum for various modified gravity

b. possibility of detection

c. parameter estimation for models with primordial gravitational wave

4. Yi Yang:

a. Test of various inflation models by stochastic background GW

5. Kipp Cannon:

- a. search for astrophysical background from asymmetric boson clouds condensed around and driven by Kerr BHs
- b. binary merger "popcorn" stochastic background

6. Sachico Kuroyanagi

a. development of KAGALI

b. search using broken power-law templates

7. Jishnu Suresh:

a. Directional Search with multi-detectors

8. Guo Chin Liu:

a. Directional search with multi-detectors

8 PIs, 4 theoretical studies, 4 data analysis

Publication Plans

With KAGRA data

Improvement of isotropic/directional search

- Jishnu, Nishizawa



01+02	8.2x10 ⁻⁸	1.2x10 ⁻⁷	4.2x10 ⁻⁷
detector network	$\Omega_{\rm gw}^T$	$\Omega_{\rm gw}^V$	$\xi \Omega_{\rm gw}^S$
early O3, HLV	4.2×10^{-8}	1.1×10^{-7}	6.8×10^{-8}
early O3, HLK	2.8×10^{-7}	7.4×10^{-7}	4.3×10^{-7}
early O3, HVK	4.9×10^{-7}	5.3×10^{-7}	5.3×10^{-7}
early O3, LVK	4.3×10^{-7}	9.9×10^{-7}	9.9×10^{-7}
early O3, K combined	2.1×10^{-7}	4.0×10^{-7}	3.2×10^{-7}
O4, HLV	1.1×10^{-8}	2.9×10^{-8}	1.4×10^{-8}
O4 w/ low K, HLK	5.3×10^{-8}	1.2×10^{-7}	8.2×10^{-8}
O4 w/ low K, HVK	7.6×10^{-8}	8.0×10^{-8}	4.3×10^{-8}
O4 w/ low K, LVK	7.4×10^{-8}	1.7×10^{-7}	1.6×10^{-7}
O4 w/ low K, K combined	3.7×10^{-8}	6.2×10^{-8}	3.7×10^{-8}
O4 w/ high K, HLK	2.3×10^{-8}	4.8×10^{-8}	3.5×10^{-8}
O4 w/ high K, HVK	3.6×10^{-8}	3.8×10^{-8}	2.2×10^{-8}
O4 w/ high K, LVK	3.6×10^{-8}	7.2×10^{-8}	7.2×10^{-8}
O4 w/ high K, K combined	1.7×10^{-8}	2.8×10^{-8}	1.8×10^{-8}

HLVK=HLK+HVK+LVK

For O3: 1-yr obs. for LHV and 0.5-yr obs for K (25Mpc) For O4: 1-yr obs. For all detectors

By Nishizawa https://gwdoc.icrr.u-tokyo.ac.jp/cgi-bin/private/DocDB/ShowDocument?docid=10264

LIGO Document G1801863-v1

Publication Plans

Without KAGRA data

- Broken power law
 - Two power indices + energy density @ turning point
 - Kuroyanagi & Liu
- Circular polarized isotropic SGWB
 - Study the parity violation in the early universe
 - S5 data has been used to study the circular polarization mode (Crowder et al. 2013)
 - Collaborating with K.-W. Ng and Y. Chu



Computing Issues

- PyStoch Jishnu, stable version will be released soon
- GPU pipeline: Guo Chin Liu

GPU	performance(float/double) TFLOPS	# of card
K80	4.113/1.371	1
P100	9.3/4.7	12
V100	14.0/7.0	2

Timeline of LVC Stochastic

Date	Paper	Milestone
TBD (2019-12-18?)	O3a directional stochastic	First (prelim) results available for review
2020-01-01	O3a directional stochastic	First complete draft to working group(s)
2020-02-01	O3a directional stochastic	Initial circulation to LVC
TBD (2020-02-22?)	O3a directional stochastic	Final results available
TBD (2020-02-25?)	O3a directional stochastic	Mature draft circulation to LVC
TBD (2020-03-01?)	O3a directional stochastic	Presentation to LVC
TBD (2020-03-12?)	O3a directional stochastic	Complete review of final results
TBD (2020-03-13?)	O3a directional stochastic	Seek paper approval by LVC
TBD (2020-03-21?)	O3a directional stochastic	Final circulation of approved paper
2020-04-01 (est)	O3a directional stochastic	Paper release (as preprint)
TBD (2020-04-01?)	O3a directional stochastic	Initial journal submission
TBD (2020-05-31?)	O3a directional stochastic	Resubmission to journal
2020-06-01 (est)	O3 isotropic stochastic	First (prelim) results available for review
2020-06-01 (est)	O3 cosmic string search	Final results available
TBD (2020-06-03?)	O3 popcorn Bayesian search	First (prelim) results available for review
TBD (2020-06-17?)	O3 popcorn Bayesian search	First complete draft to working group(s)
2020-07-01 (est)	O3 popcorn Bayesian search	Initial circulation to LVC
TBD (2020-07-04?)	O3 all-freq radiometer	First (prelim) results available for review
TBD (2020-07-04?)	O3 cosmic string search	First (prelim) results available for review
TBD (2020-07-18?)	O3 all-freq radiometer	First complete draft to working group(s)
TBD (2020-07-18?)	O3 cosmic string search	First complete draft to working group(s)
2020-08-01 (est)	O3 isotropic stochastic	First complete draft to working group(s)
2020-08-01 (est)	O3 all-freq radiometer	Initial circulation to LVC
2020-08-01 (est)	O3 cosmic string search	Initial circulation to LVC
TBD (2020-08-03?)	O3 popcorn Bayesian search	Final results available
TBD (2020-08-05?)	O3 cosmic string search	Mature draft circulation to LVC
TBD (2020-08-07?)	O3 popcorn Bayesian search	Mature draft circulation to LVC
TBD (2020-08-13?)	O3 cosmic string search	Presentation to LVC
TBD (2020-08-14?)	O3 popcorn Bayesian search	Presentation to LVC
2020-08-15 (est)	O3 isotropic stochastic	Initial circulation to LVC
TBD (2020-08-22?)	O3 all-freq radiometer	Final results available
2020-08-23 (est)	O3 isotropic stochastic	Final results available