Mannual of International Mini-Workshop

Gravitational Waves in the Early Universe

“早期宇宙中的引力波”国际小型学术研讨会

会议手册

Handbook

Institute of Theoretical Physics, Chinese Academy of Sciences
Center for High Energy Physics, Peking University

中国科学院理论物理研究所/北京大学高能物理研究中心

October 14-15, 2023

International Mini-Workshop

Gravitational Waves in the Early Universe

With the detection of gravitational waves from the merger of binary black holes by LIGO, we officially entered the era of gravitational wave cosmology. During the early universe, many interesting physical processes could generate gravitational waves, which were usually associated with new physics beyond the standard model. This opens up a new observational window for humanity to further uncover the origins of the universe and its matter content. These gravitational waves are generated at different epochs and propagate through the cosmic history until the present, which are redshifted to different frequency bands. In the recent future, various gravitational wave detection projects are planned, including CMB-S4, LiteBIRD, BICEP3/Keck Array, AliCPT utilizing the B-mode polarization of the cosmic microwave background radiation; NANOGrav, EPTA, PPTA, CPTA using pulsar timing arrays; LISA, Taiji, TianQin utilizing space-based gravitational wave interferometers; and ET, BBO for ground-based gravitational wave interferometers. Recently, the NANOGrav, EPTA, and CPTA jointly announced strong evidence for the existence of a nanohertz stochastic gravitational wave background. This has reignited our interest in gravitational waves produced in the early universe.

In order to further advance research in relevant fields, we hold this international workshop, inviting active experts who are interested in related topics to participate. The aim is to promote further combination of theory and observation in the gravitational wave cosmology, and to foster collaboration among international scholars. The website is https://indico.itp.ac.cn/event/171/.

Venue: Room 6620, ITP South Building

Schedule: Register on Oct 13th (Fri). Workshop on Oct 14th (Sat) and 15th (Sun). Leave on Oct 16th (Mon).

Sponsors: This workshop is sponsored by ITP, CAS, by the Center for High Energy Physics, Peking University, and by the National Key Research and Development Program of China Grant No. 2021YFC2203004.

Organizers: Cristian Joana, Li Li, Shi Pi, Shao-Jiang Wang, Yong Zhou

小型国际学术研讨会

“早期宇宙中的引力波”

中国科学院理论物理研究所及北京大学高能物理研究中心将于 2023 年 10 月 13 日至 16 日在中国科学院理论物理研究所联合举办“早期宇宙中的引力波”小型国际学术研讨会。会议网址：https://indico.itp.ac.cn/event/171/。

随着 LIGO 观测到双黑洞合并的引力波，人类正式进入引力波宇宙学时代。在早期宇宙中，很多有趣的物理过程都能产生引力波。它们通常都和超出标准模型的新物理相联系，是人类进一步揭开宇宙起源和物质起源的一个新的观测窗口。这些引力波诞生于宇宙的不同时期，可能出现在许多可探测频段上。未来十几年内将有不同的引力波探测计划进行探测。其中包括间接利用微波背景辐射 B 模偏振的 CMB-S4、LiteBIRD、BICEP3/Keck Array、AliCPT；利用脉冲星测时阵列的 NANOGrav, EPTA, PPTA, CPTA；空间引力波干涉仪的 LISA、太极、天琴；地面引力波探测器的 ET、BBO 等。最近，NANOGrav, EPTA, CPTA 等脉冲星测时阵列观测组同时宣布观测到纳赫兹随机引力波背景存在的强烈证据。这重新燃起了我们对早期宇宙中产生的引力波的兴趣。

为了进一步推进相关领域的研究，我们特地组织召开此次国际学术研讨会。会议不收注册费，食宿及交通自理。外地老师的住宿统一安排在北京市海淀区西郊宾馆（北京市海淀区王庄路 18 号 http://www.xijiaohotel.cn/)。

本次会议由中国科学院理论物理研究所及北京大学高能物理研究中心联合举办，并受到科技部国家重点研发计划“引力波探测”专项项目“宇宙弦等新颖引力波源与随机引力波背景的特征和信号识别研究”(项目号 2021YFC2203004)的资助。

地点：中国科学院理论物理研究所南楼 6620 会议室
日程：2023 年 10 月 13 日—10 月 16 日
10 月 13 日报到，14—15 日两天会议报告，16 日自由讨论、离会
组织者：Cristian Joana，皮石，李理，王少江，周勇
联系人：吕律，倪清容，皮石，王嘉宁

Schedule of the International Mini-Workshop
"Gravitational Waves in the Early Universe"
"早期宇宙中的引力波"国际小型研讨会日程

10 月 14 日

会议地点：理论所南楼 6620

Opening 开幕式及特邀报告		
Time	**Speaker**	**Title**
9:00- 9:10	Rong-Gen Cai 蔡荣根	Opening 开幕致辞
9:10- 10:00	Yue-Liang Wu 吴岳良	TBA
10:00- 10:20	Tea break and photo 茶歇、合影	

SGWB 随机引力波背景		**Chair: Bin Chen 陈斌**
Time	**Speaker**	**Title**
10:20- 11:10	Misao Sasaki 佐佐木节	PBH formation from highly non-Gaussian tails of probability distribution

11:10- 11:40	Yizhong Fan 范一中	Neutron star mergers and the fundamental physics
11:40- 12:10	Yu-Xiao Liu 刘玉孝	Polarization modes of gravitational waves
12:10- 12:40	Yi Wang 王一	Do super-horizon PGWs stay constant?
12:40- 14:00	Lunch break 午餐	

New GW Sources 新颖引力波源		**Chair: Jianxin Lu 卢建新**
Time	**Speaker**	**Title**
14:00- 14:50	Jinn-Ouk Gong 孔镇郁	Recent studies on gravitational wave
14:50- 15:20	Xin Zhang 张鑫	Exploring the nature of dark matter and dark energy with hydrogen atoms
15:20- 15:50	Ligong Bian 边立功	Topological defects in the early Universe
15:50- 16:20	Haipeng An 安海鹏	Gravitational waves from phase transitions during inflation
16:20- 16:30	Tea break 茶歇	

PGW 原初引力波		**Chair: Lixin Xu 徐立昕**
Time	**Speaker**	**Title**
16:30-17:00	Wen Zhao 赵文	Primordial Gravitational Waves
17:00-17:30	Taotao Qiu 邱涛涛	Tensor Perturbations from Bounce Inflation Scenario in f(Q) Gravity
17:30-18:00	Yi-Fu Cai 蔡一夫	Stochastic gravitational waves from non-perturbative resonances and non-Gaussian tails in the very early universe
18:00-18:30	Wenbiao Han 韩文标	The waveform and physics of B-EMRI
18:30-21:00	Dinner 晚餐	

10 月 15 日

会议地点：理论所南楼 6620

Detection 1 引力波探测一		**Chair: Hongwei Yu 余洪伟**
Time	**Speaker**	**Title**
9:00-9:50	Jianwei Mei 梅建伟	TianQin Project and its progress

9:50- 10:40	Kejia Lee 李柯伽	Progress of Chinese Pulsar Timing Array (CPTA)
10:40- 10:50	茶歇 Tea break	

Detection 2 引力波探测二		**Chair: Jiliang Jing 荆继良**
Time	**Speaker**	**Title**
10:50- 11:40	Hong Li 李虹	Introduction and Progress of Ali CMB Polarization Telescope (AliCPT)
11:40- 12:30	Kazunori Kohri 郡和范	New research directions in high-frequency gravitational wave
12:30- 13:00	Lunch break 午餐	

GW astronomy 1 引力波天文一		**Chair: Renxin Xu 徐仁新**
Time	**Speaker**	**Title**
14:00- 14:30	Yungui Gong 龚云贵	Probe of Black hole charge with EMRIs
15:00- 15:30	Bin Hu 胡彬	Gravitational wave lensing

14:30-15:00	Xingjiang Zhu 朱兴江	Subtracting compact binary foreground sources to reveal primordial gravitational-wave backgrounds
15:30-16:00	Kohei Inayoshi 稻吉恒平	Gravitational waves from massive black hole binaries: the rate and strength predicted from observed high-redshift quasar populations
16:00-16:10	Tea break 茶歇	

GW Astronomy 2 引力波天文二　　Chair: Yun-Song Piao 朴云松		
Time	**Speaker**	**Title**
16:10-16:40	Qing-Guo Huang 黄庆国	Search for Gravitational-wave background in Pulsar Timing Array
16:40-17:10	Lijing Shao 邵立晶	Decihertz Gravitational-wave Astrophysics and Cosmology
17:10-17:40	Kenji Kadota 门田健司	Multi-messenger probes on dark matter surrounding a black hole
17:40-18:10	Atsuhisa Ota 太田敦久	Radiation exchange for gravitational wave equal time power spectrum
18:10-21:00	Dinner 晚餐	

Participants List

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