浙江大学长聘教授（副教授）申报表

（校内预聘制教师用）

姓　名：	GENTARO WATANABE
职工号：	0016020
单　位：	物理学院
所在一级学科：	物理学
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一、简况

姓名	GENTARO WATANABE	性别	男	出生年月	1976 年 02 月	国籍	日本
现党政职务				现工作单位		物理学系	
现聘岗位类别	百人计划研究员(自然科学 B 类)			聘任期限		自 2016-03-01 至 2022-06-30	
所在一级学科	物理学						
所在二级学科	理论物理						
从事专业及专长	Theory of cold atomic gases and thermodynamics of small systems						
最后学历、毕业学校、所学专业、学位及取得时间、导师姓名	博士研究生毕业 、The University of Tokyo、Physics、理学博士、2003-03、Katsuhiko Sato						

主要学术兼职

（兼任专业学会、协会职务、专业期刊编委等，请注名起讫年月）

(In reverse chronological order)

- Guest editor for a special issue on "Thermodynamic Control" of Journal of Physics Communications by IOP Publishing (November 2021 – present)

I was invited by IOP Publishing to be a guest editor for a special issue of Journal of Physics Communications.

- PhD Thesis Reviewer and Defense Committee for Gwangju Institute of Science and Technology (GIST) (May 2020)

I was invited by Gwangju Institute of Science and Technology (GIST), Korea as a reviewer of a PhD thesis by Mr. Juhee Lee [advisor: Prof. Dong-Hee Kim]: "Theoretical Studies on Spin-Orbit-Coupled Fermi Superfluids and Many-Body Localization in Low Dimensions", and a member of his thesis defense committee.

- External reviewer for faculty recruitment of the Inter-University Centre for Astronomy and Astrophysics (IUCAA) in Pune, India (November 2019 – December 2019)

I was asked by the Inter-University Centre for Astronomy and Astrophysics (IUCAA), India to be an external reviewer for the faculty recruitment for a tenured/tenure-track assistant professor position.

	• Reviewer of the ERC Starting Grant 2019 of the European Research Council (ERC) (March 2019 - May 2019) I was invited by the European Research Council as a reviewer of the ERC Starting Grant 2019. This grant is for a 5-year project and the total budget is around 1.5 million EUR. • PhD Thesis Reviewer and Defense Committee for OIST (October 2016 - January 2017) I was invited by Okinawa Institute of Science and Technology (OIST), Japan as a reviewer of a PhD thesis by Mr. O'Riordan Lee James [advisor: Prof. Thomas Busch]: "Non-equilibrium vortex dynamics in rapidly rotating Bose–Einstein condensates", and a member of his thesis defense committee. The final defense was held on 13 January 2017. Duration: October 2016 - January 2017. • Tenure evaluation reviewer for the UMass Boston (August - September 2017) I was asked by the Department of Physics of the University of Massachusetts Boston, USA to be a reviewer for the tenure evaluation of one of their assistant professors. • Reviewer of scientific journals (whole period) I have been serving as a reviewer of various major physics journals such as those by APS (Reviews of Modern Physics, Physical Review Letters, Physical Review X, Physical Review Research, Physical Review A, B, C, E), New Journal of Physics, etc.
个人简历（从大学开始，采用时间倒序方式填写，时间不间断）	
学习进修经历	自何年月至何年月，在何地、何学校（何单位），何专业，学习、进修，导师 1.2000-04 至 2003-03, The University of Tokyo, Physics, 博士研究生毕业, Katsuhiko Sato 2.1998-04 至 2000-03, The University of Tokyo, Physics, 硕士研究生毕业, Katsuhiko Sato 3.1994-04 至 1998-03, Kwansei Gakuin University, Physics, 全日制普通高校本科毕业, 4.1991-04 至 1994-03, Kwansei Gakuin High School, General Course (in Japanese system), 高中毕业,

工作经历	自何年月至何年月，在何地、何学校（系所）、何单位任职，任何职（海外职位英文表述） 1. 2016-03 至 2022-06, 中国, Zhejiang University, ZJU 100 Young Professor 2. 2015-09 至 2016-02, 韩国, University of Science and Technology (UST), Adjunct Professor 3. 2015-05 至 2016-02, 韩国, Institute for Basic Science (IBS), Research Fellow 4. 2010-05 至 2015-04, 韩国, Asia Pacific Center for Theoretical Physics (APCTP), Group Leader/Assistant Professor 5. 2010-05 至 2015-04, 韩国, POSTECH, Adjunct Assistant Professor 6. 2009-04 至 2010-04, 日本, RIKEN, Special Postdoctoral Researcher 7. 2007-04 至 2009-03, 意大利, University of Trento, Postdoctoral Fellow 8. 2005-04 至 2007-04, 丹麦, Nordic Institute for Theoretical Physics (NORDITA), JSPS Postdoctoral Fellow (海外) 9. 2004-04 至 2005-03, 丹麦, Nordic Institute for Theoretical Physics (NORDITA), Nishina Postdoctoral Fellow 10. 2003-04 至 2004-03, 日本, The University of Tokyo, JSPS Postdoctoral Fellow 学习、工作经历如果不连续请说明原因： 无

二、立德树人成效概述

2.1 在课程教学、科学研究、指导学生、参与学生社会实践和社团活动、担任班主任、德育导师、新生之友、招生就业等方面落实立德树人根本任务的情况和成效。

Throughout my employment period, I have committed to the talents cultivation and mentoring students/post-docs with enthusiasm. At the same time, I have tried to keep on improving myself as a mentor and a role model for students. Through my lectures and mentoring, I have tried to convey the joy of physics, understanding of physics, excitement of scientific exploration, professionalism, and academic morality.

During the last six years, I have accepted graduate students constantly (one student per one and a half years on average), and currently (at the moment of March 2022) I have four PhD students in my group. The first two of them who joined my group in September 2016 and in September 2017 (the latter officially joined in March 2019) are going to finish their PhD this year.

I have experience in mentoring post-docs in my previous workplace, which I worked for as a faculty member. There, I have mentored four post-docs in total, and three of them have already obtained faculty positions. The fundamental practices of my mentoring are very careful observation and appropriate communication for each student and post-doc. I take sufficient time to understand each student and post-doc (for the both aspects of their personality and scientific ability/aptitude) through various occasions such as daily discussions, book-reading meetings, regular group meetings, etc. Since each person has different characteristics, the detailed approach of my mentoring is different for each individual. Through my mentoring, I have successfully motivated my students; as a matter of fact, although three of my students enrolled as master students at the beginning, all of them finally hoped to pursue their PhDs in my group.

In addition to the graduate students, I have accepted three post-doc researchers: Dr. Kosuke Ito (April 2018 - August 2019), Dr. Kui-Tian Xi (奚揆天) (October 2018 - November 2021), and Dr. Yuki Minami (July 2019 - present). It is noted that all the post-docs have managed to develop their career after the time in my group. Dr. Kui-Tian Xi has successfully obtained a **tenured associate professor/researcher position** (上岗副研究员) in Nanjing University of Aeronautics and Astronautics (南京航空航天大学). Dr. Kosuke Ito obtained a 5-year post-doc position in Osaka University. Dr. Yuki Minami has published two papers in Physical Review Letters during his time in my group.

2.2 近 3 年学校年度考核情况

2019 优秀
2020 合格
2021 优秀

三、人才培养、教育教学工作概述

3.1 教育理念，本科教育教学、研究生教育教学等情况和成效

My teaching philosophy is "Teaching by asking". By asking scientific questions to students, they can ask and think through the questions by themselves, and consequently, they can learn the subject actively, get better understanding, learn how to learn, and learn how to find new scientific problems. Through my teaching activities in Zhejiang University, this philosophy is well received, especially in the graduate courses.

With this philosophy, I have been making a strong commitment to teaching during the period of my employment. In my first three years starting from March 2016, I gave lectures far more than the requirement (in the first two years, for each year respectively, I gave for 32 school hours although the teaching was exempted; in the third year, I gave for 64 school hours while the requirement was 45 school hours). More importantly, courses which I was in charge of were rated very high. Especially, General Physics I (H) (普通物理学 I (H)) for the CKC college (竺可桢学院) in the undergraduate school has been selected as **"2020 年度省级线下一流课程"** of Zhejiang province, and I have been serving as one of the major members of the teaching team of this course. In addition, in the first year of my employment, I took charge of a new course "Topics of Theoretical Physics" (理论物理专题) for graduate school, and I have designed the course syllabus and the course material from scratch. Especially, I have prepared a comprehensive original textbook over 150 pages on theoretical mechanics, special relativity, and the application of theoretical mechanics to electromagnetism for this course. According to the course evaluation by students, the overall scores (总体评分) of this course in 2016 and 2017 are 5.0 (out of 5.0).

Furthermore, as a faculty member of condensed matter theory group in Zhejiang Institute of Modern Physics (浙江近代物理中心), I have contributed to the teaching for the courses on condensed matter physics of graduate school by closely collaborating with other group members. So far, I have provided 非平衡态统计物理, 固体理论 I, and 固体理论 II; all of these courses were also rated very high.

3.2 承担教学及人才培养情况

1.开设课程情况

授课名称	授课时间	授课对象	讲授课时数	授课人数	评估结果
1. 理论物理专题, 2016-2017 秋冬, 研究生, 32,25,5.0					
2. 理论物理专题, 2017-2018 秋冬, 研究生, 32,20,5.0					
3. 经典物理, 2018-2019 秋冬, 研究生, 48,16,4.8					
4. 非平衡态统计物理, 2018-2019 秋冬, 研究生, 32 (my part is 16),9,5.0					
5. 普通物理学Ⅰ（H）, 2018-2019 春夏, 本科生, 64,52,4.7890 良好					
6. 《固体理论》I, 2019-2020 秋冬, 研究生, 64 (my part is 16),49,4.9					
7. 普通物理学Ⅰ（H）, 2019-2020 春夏, 本科生, 64,35,4.7920 良好					
8. 《固体理论》II, 2019-2020 春夏, 研究生, 64 (my part is 32),8,4.9					

9. 普通物理学Ⅰ（H），2020-2021春夏，本科生，64,37,4.594
10. 《固体理论》II，2020-2021春夏，研究生，64（my part is 32),18,4.7
11. 普通物理学Ⅰ（H），2021-2022春夏，本科生，64,76,To be evaluated
12. 《固体理论》II，2021-2022春夏，研究生，64（my part is 32),8,To be evaluated

2. 指导本科生毕业论文（设计）情况

姓名	专业	年级	在候选人指导下获得的奖励
1.吴致远，求是物理班，2015,			
2.李天瑞，物理系，2016,			

3.指导研究生情况

姓名	研究生类型	专业	年级	在候选人指导下获得的奖励
1.徐国华，博士研究生，物理学，2021,				
2.肖腾，博士研究生，物理学，2020,				
3.吕桂桃，博士研究生，理论物理，2019,				
4.姜超，博士研究生，理论物理，2018,				
5.徐国华，硕士研究生，物理学，2019,				
6.姜超，硕士研究生，理论物理，2016,				

4.教学学术情况

（包括国家规划教材编写、教学成果奖励、课程建设等方面的情况。有合作情形的，请注明个人贡献）

"2020年度省级线下一流课程" of Zhejiang province: General Physics I (H) (普通物理学 I (H)) for the CKC college (竺可桢学院) in the undergraduate school; I am one of the major members of the teaching team (团队主要成员) of this course.

四、主要学术成就（含学术研究概述、代表性成果与贡献点，总体不超过2000字）

学术研究概述

（包括学术研究方向、创新点、贡献及代表性成果，不超过500字）

The central field of my research during the employment period is non-equilibrium and/or open quantum systems, mainly cold atomic gases, interplaying with other sub-branches of physics such as thermodynamics, statistical mechanics, condensed matter physics, and nuclear astrophysics. The ultimate goal of this program is to get a deeper understanding of the nature with applications to quantum/microscopic technologies. Through this cross-disciplinary research program, I managed to make important achievements in several research areas: 1) quantum thermodynamics and thermodynamics of small systems, especially on heat engines, aiming at finding a guiding principle to design energy-efficient thermal machines 2) quantum simulation of neutron star matter using cold atomic gases towards understanding neutron star matter and related phenomena, and 3) non-equilibrium phenomena in cold atomic gases. More specifically, in the first area 1), I have found the quantum enhancement effect

	of work extraction from quantum heat engines operating over multiple cycles and quantum statistical enhancement of work extraction from an ensemble of indistinguishable quantum heat engines. In addition, I have formulated finite-time thermodynamics of fluctuations in microscopic heat engines. In the second area 2), I have provided a clear understanding of the effects of pairing gap and band gap on the superfluid density in neutron star crusts, and our work has saved pulsar glitch models based on neutron superfluidity whose validity was in question recently. In the third area 3), I have discovered the novel pairing dynamics in quantum-quenched p-wave superfluid Fermi gases. The detailed explanation of these achievements will be given in the next section on "代表性成果及贡献点". My Work Goals and Responsibilities (岗位工作目标及工作任务书) states, *"Our research achievements will be published in 2-3 papers per year in leading international physics journals such as Physical Review, New Journal of Physics, and other SCI journals with a comparable impact factor."*; **I have managed to exceed this goal**, especially in terms of quality. During the last six years of my employment period starting from March 2016, I have published **four papers in Physical Review Letters as the first and/or corresponding author** in addition to one paper in npj Quantum Information and 10 papers in other SCI/SCIE/ESCI journals such as Physical Review Research and Physical Review A (in total, I have published 17 papers; among them, 15 papers are in SCI/SCIE/ESCI journals, and 5 papers are in Q1 journals). One of the papers published in Physical Review Letters has been selected as an Editors' Suggestion, featured in APS Physics Synopsis, and nominated as one of the candidates of the "10 Academic Breakthroughs of Zhejiang University in 2017" (浙江大学 2017 年度十大学术进展).
代表性成果及贡献点	（代表性成果及贡献点不超过 3 项，每项不超过 500 字。阐述重要创新成果、主要学术贡献及其科学价值或社会经济意义等，并列出相应的成果证据，如论著、项目、奖项、专利等已在后续表格中列出的成果，标明序号即可） **1) Performance of quantum heat engines** [GW et al., PRL **118**, 050601 (2017) (Editors' Suggestion); PRL **124**, 210603 (2020); for both papers, I am the first and corresponding author.] Advances in technology have enabled us to downsize heat engines and recent development has spurred the fabrication of heat engines at the nanoscale. Quantum heat engines (QHEs), microscopic heat engines whose working substance is a quantum system, are expected to show exotic properties, which cannot be obtained in macroscopic ones governed by classical mechanics. Theoretical studies of QHEs are largely motivated by fundamental questions that address the interplay between thermodynamics and statistical mechanics in the quantum

world. In common wisdom, thermodynamics is regarded as a theory for macroscopic systems. Interesting and important questions are: How small can a system go for thermodynamics to be applicable? Is the formulation of thermodynamics possible for small systems? How do the laws of thermodynamics emerge from quantum mechanics? An understanding of QHEs would give an important clue to these fundamental questions.

In existing works, the performance of QHEs is usually assessed for a single isolated engine for a single cycle. This approach assumes that the work done by multiple engines through multiple cycles is proportional to the number of engines and the number of cycles. It further assumes that the internal state of the engines is unaffected by the coupling to an external system in extracting the work. Since QHEs, however, are often very susceptible to the outcoupling due to their smallness, their actual performance when they are coupled to an external system is a very important issue. We have challenged the above mentioned conventional approach and have shown that the performance of QHEs over many cycles cannot be assessed by analyzing only a single engine for a single cycle; instead, **assessments of the performance should address the global process over many cycles and the collective effect by multiple engines**.

In the first paper [PRL **118**, 050601 (2017)], we have found that, due to the intercycle quantum coherence, the total amount of work done by a QHE through multiple cycles is not equal to the work done through a single cycle multiplied by the number of cycles. Further, we have shown that optimizing the engine over multiple cycles leads to the identification of **scenarios with a quantum enhancement**: more work can be extracted compared to the single-cycle case using the constructive interference due to intercycle quantum coherence. In the second paper [PRL **124**, 210603 (2020)], we consider an ensemble of indistinguishable bosonic QHEs, and have discovered the **quantum statistical enhancement of work output arising from the permutation symmetry** in the ensemble. These results should find broad applications in the design of energy-efficient thermal machines at the nanoscale.

The first paper was selected as an Editors' Suggestion, featured in APS Physics Synopsis, and nominated as a candidate of the "10 Academic Breakthroughs of Zhejiang University in 2017". This work has already been well received in the field (60 SCI cites and 80 cites in Google Scholar).

2) Understanding of neutron superfluid density in neutron stars: Superfluid density under the competition between the band gap and pairing gap

[GW and C. J. Pethick, PRL **119**, 062701 (2017); I am the first and corresponding author.]

Pulsars — rotating neutron stars emitting an electromagnetic beam, which is observed as regular pulse signals — behave as very accurate natural clocks. Though accurate, it is also known that the interval of the pulse signals can occasionally

suddenly decrease, which is caused by a sudden increase of the rotation frequency of neutron stars. This mysterious phenomenon is called a "glitch", and how to understand glitches is an important problem in the physics of neutron stars. One of the most promising models for understanding them is the sudden locking together of the neutron superfluid to the charged particles in the crust of neutron stars. This problem is thus also related to the response of superfluids to a vector probe, which is a fundamental problem of the non-equilibrium properties of superfluids.

However, the glitch models based on superfluidity are facing a serious crisis: On the basis of recent calculations of the neutron superfluid density, which assume weak pairing, it has been argued that, due to the effects of neutron band structure, the neutron superfluid density in the crust is so small that the crust alone is insufficient to account for the magnitude of neutron star glitches.

Our work has saved the glitch models from this crisis. Inspired by our earlier work on ultracold atomic gases in an optical lattice, we have studied neutron superfluid density in a periodic lattice in the mean-field approximation. By taking into account **both the effects of band gap and pairing gap on an equal footing**, we have shown that the effects of band structure are strongly suppressed when the pairing gap is comparable to or greater than the strength of the lattice potential. By applying the results to the inner crust of neutron stars, we have found that the neutron superfluid density in the crust is large enough that glitch models based on the superfluid neutrons are still tenable. Our work has already been appreciated as an important result by the neutron star physics community (42 SCI cites, 70 cites in Google Scholar), and has an impact on the developments in the field. This work is a good example of success of my cross-disciplinary research program.

3) Discovery of novel pairing dynamics in p-wave superfluid Fermi gases

[S. Yoon and GW, Phys. Rev. Lett. **119**, 100401 (2017); I am a co-corresponding author. As a supervisor of Dr. Yoon, I organized the project, designed the problem, and discussed the simulation results. Together with Dr. Yoon, I also wrote the paper.]

The quench problem is one of the most basic setups for studying non-equilibrium dynamics. Ultracold atomic gases provide us unprecedented opportunities for studying the relaxation process of an isolated quantum system after a sudden quench because of their clean nature and their large dynamical timescale compared to the other condensed matter systems such as electrons in solids. Among quantum phenomena, the pairing of fermions is a profound phenomenon in many different areas of physics, from matter inside neutron stars, to superconductivity. However, despite the importance of pairing in high angular momentum states in physics, the study of the quench dynamics of p-wave pairing in cold atomic gases is still in its early stages.

Under such circumstances, we have performed the first study on the quench dynamics of p-wave polar states in 3D superfluid Fermi gases. The anisotropy of the pairing

	interaction together with the presence of the centrifugal barrier results in profoundly different pairing dynamics compared to the s-wave case. Specifically, we have discovered the novel dynamics of a hole-burning and a particle-peak in the momentum occupation and the emergence of a vortex-ring structure in pair amplitudes. Our work has also clarified the mechanism of these dynamics and has figured out the important role of the quasi-bound (resonant) state in the quench dynamics. Since the dynamics of the pairing field is in close connection with the dynamics of the momentum distribution, which is a measurable quantity in cold atom experiments, our results on the novel pairing dynamics are expected to be verified in future experiments of p-wave superfluid Fermi gases.

五、科研主要情况（聘期内或近五年）

5.1 承担主要科研项目

项目名称	项目性质及来源	项目经费（括号内为本人主持经费）（单位万元）	项目起讫年月	本人排序

1.基于冷原子气体的中子星物质的量子模拟，纵向，国家自然科学基金委员会，72.2(61.0)，2017-01-2020-12，1/4
2.从量子热机的统计性质到量子热力学，纵向，国家自然科学基金委员会，71.3(60.0)，2020-01-2023-12，1/5
3.关于量子热机的研究——旨在理解非平衡量子热力学，纵向，浙江省自然科学基金委员会，45.5(35.0)，2019-01-2022-12，1/4
4.基于冷原子气体的非平衡量子热力学研究，其它，浙江大学，(10.0)，2017-01-2018-01，1/2
5.开放量子系统几何相的调控及其应用，其它，浙江大学，(9.46)，2018-01-2018-12，2/2
6.青年千人计划国家科研补助项目经费，其它，国家千人计划，(95.83)，2017-01-2022-06，1/1
7.物理系百人计划渡边元太郎(Gentaro Watanabe)研究员科研启动经费，其它，浙江大学，45.37(45.37)，2016-03-2022-03，1/1

5.2 获奖情况

获奖项目名称	奖励名称及等级	授奖单位	获奖年月	本人排序

1. 浙江大学 2017 年度物理学系先进工作者，2017 年物理学系院级先进，浙江大学，2017-12，
2. 浙江大学 2021 年度物理学系先进工作者，2021 年物理学系院级先进，浙江大学，2021-12，

5.3 获得专利情况

专利名称	专利授权国、专利号	专利类型	授权公告年月	本人排序

5.4 代表性论文、著作情况（以浙江大学为第一署名单位，否则请注明）

论文：所有作者姓名（本人名字请加粗，通讯作者名字上用*标示），论文题目，发表期刊名称，发表年月，卷，期，起止页码。（共同一作或共同通讯作者请注明个人贡献）

1. Gentaro Watanabe*, B. Prasanna Venkatesh, Peter Talkner, and Adolfo del Campo, Quantum Performance of Thermal Machines over Many Cycles, Physical Review Letters, 2017-02, 118, 5, 050601-, 第一作者

2. Gentaro Watanabe* and C. J. Pethick, Superfluid Density of Neutrons in the Inner Crust of Neutron Stars: New Life for Pulsar Glitch Models, Physical Review Letters, 2017-08, 119, 6, 210603-, 第一作者

3. Gentaro Watanabe*, B. Prasanna Venkatesh*, Peter Talkner, Myung-Joong Hwang, and Adolfo del Campo, Quantum Statistical Enhancement of the Collective Performance of Multiple Bosonic Engines, Physical Review Letters, 2020-05, 124, 21, 210603-, 第一作者

4. (非浙大第一署名单位) Sukjin Yoon* and Gentaro Watanabe*, Pairing Dynamics of Polar States in a Quenched p-Wave Superfluid Fermi Gas, Physical Review Letters, 2017-09, 119, 10, 100401-, 共同通讯作者

贡献描述: I am a co-corresponding author. As a mentor of Dr. Yoon, I organized the project, designed the problem, discussed the results, and wrote the paper.

5. (非浙大第一署名单位) Yang-Yang Chen, Gentaro Watanabe, Yi-Cong Yu, Xi-Wen Guan*, and Adolfo del Campo*, An interaction-driven many-particle quantum heat engine and its universal behavior, npj Quantum Information, 2019-10, 5, 88-, 其他作者

6. Gentaro Watanabe* and Yuki Minami, Finite-time thermodynamics of fluctuations in microscopic heat engines, Physical Review Research, 2022-01, 4, 1, L012008-, 第一作者

7. Kosuke Ito*, Peter Talkner, B. Prasanna Venkatesh, and Gentaro Watanabe*, Generalized energy measurements and quantum work compatible with fluctuation theorems, Physical Review A, 2019-03, 99, 3, 032117-, 共同通讯作者

贡献描述: As a mentor of Dr. Ito, I organized the project, designed the problem, discussed the analysis and results, and contributed to writing the paper.

8. Chao Jiang* and Gentaro Watanabe*, Quantum dynamics under simultaneous and continuous measurement of noncommutative observables, Physical Review A, 2020-12, 102, 6, 062216-, 通讯作者

9. Guitao Lyu* and Gentaro Watanabe*, Persistent current by a static non-Hermitian ratchet, Physical Review A, 2022-02, 105, 2, 023328-, 通讯作者

10. Guitao Lyu*, Lih-King Lim, and Gentaro Watanabe*, Floquet eigenspectra of a nonlinear two-mode system under periodic driving: The emergence of ring structures, Physical Review A, 2020-05, 101, 5, 053623-, 通讯作者

11. Gentaro Watanabe* and Yongping Zhang, Stabilization of nonlinear lattices: A route to superfluidity and hysteresis, Physical Review A, 2018-07, 98, 1, 013625-, 第一作者

12. Chao Jiang* and Gentaro Watanabe*, Application of simultaneous and continuous measurement of noncommutative observables: Preparation of the pure ideal quadrature-squeezed state by feedback control, Physical Review A, 2022-02, 105, 2, 022613-, 通讯作者

13. (非浙大第一署名单位) Gentaro Watanabe*, B. Prasanna Venkatesh*, and Raka Dasgupta, Nonlinear Phenomena of Ultracold Atomic Gases in Optical Lattices: Emergence of Novel Features in Extended States [invited review article], Entropy, 2016-03, 18, 118-, 第一作者

14. (非浙大第一署名单位) Raka Dasgupta*, B. Prasanna Venkatesh, and Gentaro Watanabe*,

Attraction-induced dynamical stability of a Bose-Einstein condensate in a nonlinear lattice, Physical Review A, 2016-06, 93, 6, 063618-, 通讯作者
15. (非浙大第一署名单位) Danh-Tai Hoang, B. Prasanna Venkatesh, Seungju Han, Junghyo Jo, Gentaro Watanabe, and Mahn-Soo Choi*, Scaling Law for Irreversible Entropy Production in Critical Systems, Scientific Reports, 2016-06, 6, 27603-, 其他作者
16. Gentaro Watanabe*, Heat Engines Using Small Quantum Systems, Bulletin of AAPPS, 2019-12, 29, 6, 30-36, 第一作者
17. Gentaro Watanabe*, Sukjin Yoon, Franco Dalfovo, and Takashi Nakatsukasa, Multiple Period States of the Superfluid Fermi Gas in an Optical Lattice, Journal of Physics: Conference Series, 2016-09, 752, 012002-, 第一作者

著作：所有作者姓名（本人名字请加粗），书名，出版地，出版社，出版年月，总字数及个人贡献数（个人贡献数标注在括号内）（字数单位：万字）

1. Gentaro Watanabe, B. Prasanna Venkatesh, and Raka Dasgupta, Non-Linear Lattice (Book chapter), Basel, Switzerland, MDPI, 2016-12, 10(2),

5.5 担任国际学术组织重要职务及在国际学术会议大会报告、特邀报告等情况

Invited talks in international meetings (in reverse chronological order)

1. *“Less is different: thermodynamics of small systems and microscopic heat engines”*, Symposium to Celebrate 30th Anniversary of ZIMP and 95th Birthday of Prof. T. D. Lee (online, Zhejiang University, China, 20 Nov. 2021).

2. *“Universal bounds for fluctuations in small, classical heat engines”*, International Workshop on “Open Quantum Dynamics and Thermodynamics” (online, PCS Institute for Basic Science (PCS-IBS), Korea, 25 Mar. 2021).

3. *“Quantum statistical enhancement of the collective performance of multiple bosonic engines”*, the 11th Dynamic Days Asia-Pacific (DDAP11) (online, National University of Singapore, Singapore, 18 Nov. 2020).

4. *“Quantum statistical enhancement of the collective performance of multiple bosonic engines”*, the 5th KIAS Workshop on “Quantum Information and Thermodynamics” (POSTECH, Pohang, Korea, 12 Nov. 2019).

5. *“Superfluid Density of Neutrons in the Inner Crust of Neutron Stars: New Life for Pulsar Glitch Models”*, the 2nd APCTP Alumni Scientific Symposium (Gyeongju Hwabaek International Convention Center, Gyeongju, Korea, 8 Nov. 2018).

6. *“Quantum performance of thermal machines over many cycles”*, APCTP-KIAS workshop on “Motors and Engines” (Korea Institute for Advanced Study, Seoul, Korea, 25 June 2018).

7. *“Superfluid Density of Neutrons in the Inner Crust of Neutron Stars: New Life for Pulsar Glitch Models”*, the Institute for Nuclear Theory workshop “Astro-Solids, Dense Matter, and Gravitational Waves” (INT 18-71W) (Institute for Nuclear Theory, University of Washington, Seattle, USA, 16 Apr. 2018).

8. *“Superfluid Density of Neutrons in the Inner Crust of Neutron Stars: New Life for Pulsar Glitch Models”*, International Symposium on “Particle Astrophysics and Cosmology, Including Fundamental Interactions” (PACIFIC 2018) (Kiroro Resort, Hokkaido, Japan, 14 Feb. 2018).

9. *“Some recent results on quantum heat engines and quantum quench dynamics”*, Multi-Disciplinary Workshop on Theoretical Physics 2017 (Asia Pacific Center for Theoretical Physics, Korea, 7 Dec. 2017).

10. *“Quantum performance of thermal machines over many cycles”*, International Workshop on “Ultracold Atomic Gases and Quantum Control” (Shanghai University, China, 24 Nov. 2017).

11. *“Quantum Performance of Thermal Machines over Many Cycles”*, Hangzhou Symposium for Young Researchers (Zhejiang University, Hangzhou, China, 3 Apr. 2017).

12. *“Quantum fluctuation theorems and power measurements”*, EMN Meeting on Quantum Communication & Quantum Imaging 2016 (QCQI 2016) (Mövenpick Hotel Berlin, Berlin, Germany, 25 Aug. 2016).

13. *“Non-linear phenomena in superfluid Fermi gases in an optical lattice — swallowtails and period doubling”*, 2016 Hangzhou Symposium on Degenerate Fermi Gases (Zhejiang University, Hangzhou, China, 30 June 2016).

Contributed talks and presentations in international meetings (in reverse chronological order)

1. Gentaro Watanabe, Kosuke Ito, and Chao Jiang, *“Universal bounds for fluctuations in small, classical heat engines”*, Conference on “Quantum Thermodynamics” (QTD 2020) (online, The Institute of Photonic Sciences, Barcelona, Spain, 20 Oct. 2020).

2. Guitao Lyu, Lih-King Lim, and Gentaro Watanabe, *“Floquet eigenspectra of a nonlinear two-mode system under periodic driving: the emergence of “ring” structures”* (poster), International Conference on “Quantum Simulations in Optical Lattices and Beyond” (Wilczek Quantum Center at Shanghai Jiaotong University, Shanghai, China, 15 Dec. 2019).

3. Kosuke Ito and Gentaro Watanabe, *“Collective enhancement of charging of quantum batteries by quantum heat engines”*, Meeting on Quantum Information Technology, the Institute of Electronics, Information and Communication Engineers (Gakushuin University, Tokyo, Japan, 19 Nov. 2019).

4. Kosuke Ito, Peter Talkner, B. Prasanna Venkatesh, and Gentaro Watanabe, *"Backaction of generalized measurements compatible with quantum fluctuation theorems"* (poster), International Conference on "Advances in Physics of Emergent Orders in Fluctuations" (APEF 2018) (University of Tokyo, Tokyo, Japan, 12 Nov. 2018).

5. Gentaro Watanabe, *"Quantum performance of thermal machines over many cycles"*, YITP Workshop on "Quantum Thermodynamics: Thermalization and Fluctuations" (Kyoto University, Kyoto, Japan, 30 Sep. 2017).

6. Gentaro Watanabe, B. Prasanna Venkatesh, Peter Talkner, and Adolfo del Campo, *"Quantum performance of thermal machines over many cycles"*, 14th Joint European Thermodynamics Conference (JETC 2017) (Budapest University of Technology and Economics, Budapest, Hungary, 23 May 2017).

7. Gentaro Watanabe, *"Multiple period states in superfluid Fermi gases in an optical lattice"*, 5th International Conference and Exhibition on "Lasers, optics and photonics" (Optics 2016) (Hilton Atlanta Airport, Atlanta, Georgia, USA, 29 Nov. 2016).

8. Gentaro Watanabe, Sukjin Yoon, Franco Dalfovo, and Takashi Nakatsukasa, *"Multiple Period States of the Superfluid Fermi Gas in an Optical Lattice"*, International Conference on the Frontiers in Atomic, Molecular, and Optical Physics (NYU Shanghai, Shanghai, China, 24 May 2016).

9. Gentaro Watanabe, *"Quantum fluctuation theorems and power measurements"* (poster), International Workshop on "Coherent Control of Complex Quantum Systems" (C3QS 2016) (OIST, Okinawa, Japan, 18 Apr. 2016).

In addition to the above scientific meetings, I have provided invited intensive lectures (three lectures on microscopic heat engines) in Waseda University, Japan. I have also provided 7 invited seminars in foreign institutes including RIKEN and IQOQI in Innsbruck during the last six years.

5.6 担任国内学术组织重要职务及在国内学术会议大会报告、特邀报告等情况

Invited talks in domestic meetings (in reverse chronological order)

1. *"Superfluid density of neutrons in the inner crust of neutron stars: New life for pulsar glitch models"*, 12th Symposium on Cold Atomic Physics for Young Researchers (Zhuhai Yuehai Hotel, Zhuhai, China, 3 Aug. 2018).

2. *“Quantum performance of thermal machines over many cycles”*, 20th Conference on Condensed Matter Theory and Statistical Physics in China (Sichuan University, Chengdu, China, 13 July 2018).

Contributed presentations in domestic meetings (in reverse chronological order)

1. Gentaro Watanabe, *“Quantum statistical enhancement of the collective performance of multiple bosonic engines”* (poster), 13th Symposium on Cold Atomic Physics for Young Researchers (Nanyang Hotel, Xi'an Jiaotong University, Xi'an, China, 1 Aug. 2019).

2. Guitao Lyu and Gentaro Watanabe, *“周期性外力驱动下非线性二能级系统的 Landau-Zener 跃迁”* (poster), 13th Symposium on Cold Atomic Physics for Young Researchers (Nanyang Hotel, Xi'an Jiaotong University, Xi'an, China, 1 Aug. 2019).

3. Chao Jiang and Gentaro Watanabe, *“Quantum nonlinear dynamics”* (poster), 13th Symposium on Cold Atomic Physics for Young Researchers (Nanyang Hotel, Xi'an Jiaotong University, Xi'an, China, 1 Aug. 2019).

4. Gentaro Watanabe, B. Prasanna Venkatesh, Peter Talkner, and Adolfo del Campo, *“Quantum performance of thermal machines over many cycles”* (poster), 11th Symposium on Cold Atomic Physics for Young Researchers, (Guoman Hotel, Shanghai, China, 31 July 2017).

In addition to the above scientific meetings, I have provided 6 invited seminars in domestic institutes including USTC and CAS in Wuhan during the last six years.

六、社会服务等情况（应包括学生工作、公共事务及获得荣誉等）

七、其他能反映学术研究水平的突出业绩

第十二批 “国家青年千人计划” 入选 (2016)

浙江省 “千人计划” 入选 (2016)

八、申请岗位工作思路及预期目标（应包括教育教学尤其是本科教学、科研、学科

建设、社会服务等方面的内容，工作思路及岗位预期目标将作为此次评价及今后岗位评估的依据。）

After obtaining the tenured associate professor position, I will continue to carry out research, teaching, and other academic activities at the same or even higher level of quality and quantity, and I will further commit to the development of the department and the university as a tenured faculty member.

1) Teaching

In close collaboration with my colleagues who is affiliated to the CKC college (竺可桢学院) such as Prof. Xin Wan and Prof. Xin Lu, I will enthusiastically contribute to further improving the curriculum of General Physics I (H) and II (H) (普通物理学 I (H), II(H)). I have often observed that students know many physical phenomena from books as knowledge, but they have not actually seen or experienced them. To obtain a sense of physical understanding of the nature, it is important to experience some basic phenomena. Thus, as one possibility, I propose to set up some demonstrations using real equipment or computer simulations.

Regarding the teaching in the graduate school, I will keep my commitment to develop the new curriculum on condensed matter physics in collaboration with my colleagues in the condensed matter theory group in the Zhejiang Institute of Modern Physics (浙江近代物理中心). In addition to developing the new curriculum, I will keep my constant effort to improve the course material. Currently, I am in charge of a topical course, Condensed Matter Theory II (固体理论 II). I am planning to refresh the material of this topical course every three years to keep the content up-to-date.

2) Research

By continuing the successful cross-disciplinary research on non-equilibrium and/or open quantum systems, I will endeavor to develop thermodynamics of fluctuations as the prime goal after obtaining the tenured position. Here, "thermodynamics of fluctuations" means a universal theory on fluctuations of thermodynamic quantities which does not require reference to each microscopic detail of the system. While conventional thermodynamics deals only with the mean value of thermodynamic quantities, fluctuations can be dominant in small systems such as quantum heat engines due to their small number of degrees of freedom. In the last six years, we have derived universal relations and universal bounds on fluctuations in small heat engines [Ito, Jiang, and Watanabe, arXiv:1910.08096], and have formulated finite-time thermodynamics of fluctuations for small heat engines [Watanabe and Minami, Phys. Rev. Research **4**, L012008 (2022)]. With these achievements as stepping stones, I will do my best to reach this ultimate goal.

3) Disciplinary development

I will keep on contributing to the academic vibrancy and the enhancement of the publicity of the department through my research and educational activities. Fostering young talents of graduate students and post-docs is my joy, and I believe that these young talents are the greatest assets produced by the university. I will devote myself to this noble job and contribute to Zhejiang University. In addition, I am happy to cooperate in the department/university operation if requested. (As a foreign faculty member, I could contribute to, e.g., some operations on international issues such as foreign students and new foreign faculty members.)

个人承诺

本人保证：所从事的学术研究符合学术道德规范要求；所提供的材料客观真实。若有弄虚作假、学术不端以及材料填写不规范等行为的，本人承担相应责任。

承诺人： 渡边元太郎

2022 年 3 月 28 日

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审核人：

2022 年 4 月 6 日