

Physics

Newsletter

October | 2023

New Member of the Department

Dr. Yuxin Zhao

Associate Professor
B.Sc., PKU; Ph.D, HKU

I am delighted to rejoin the HKU Physics family. I obtained my PhD here, and since then, many colleagues have been both my mentors and friends. Before returning to HKU, I worked as a professor at Nanjing University for around six years. My group expanded the field of symmetry-protected topological phases by incorporating new elements from projective representations of crystal symmetries. During my PhD and Postdoc periods, I applied K theory to classify topological phases with C, P, T symmetries. I started practicing calligraphy when I was 10 years old, and have continued to pursue this hobby ever since.



Other Staff Movement

- Prof. Hoi-Kwong Lo, Chair Professor, has left the department. He joined us in 2020.
- Ms. Maggie Choi, Clerk I, has left the department. She joined us in 2023.

Promotions, Awards, Research Highlights and Conference

- Prof. Xiaodong Cui has been promoted to Chair Professor.
- Dr. Jane Lixin Dai has been promoted to Associate Professor.
- Prof. Yao Wang Receives Huang Kun Prize for Solid Physics and Semiconductor Physics. <https://www.scifac.hku.hk/news/professor-yao-wang-receives-huang-kun-prize-for-solid-physics-and-semiconductor-physics>
- The fruitful dialogue between quantum informatics and highly entangled condensed matter systems has been widely appreciated and recognized

in recent years. Within this trend, quantum entanglement serves as the quintessential quantity to detect and characterise the informational and topological properties of many-body quantum states. In 2008, Li and D. Haldane (laureate of 2016 Nobel Prize in Physics) proposed the concept of entanglement spectrum (ES) and used it to show that the low-lying ES for generic gapped topological states exhibit a universal structure related to conformal field theory (CFT). This is the famous Li-Haldane conjecture. Since then, low-lying ES has been widely studied and paid attention to as a fingerprint of CFT and topology in highly entangled quantum matter. In a recent work from Dr. Zi Yang Meng's team, "Unlocking the general relationship between energy and entanglement spectra via the wormhole effect", Zheng Yan, Zi Yang Meng, Nature Communications 14, 2360 (2023) <https://www.nature.com/articles/s41467-023-37756-7>, they explained and further generalised the Li-Haldane's conjecture with a wormhole effect in the path-integral formulation that successfully unlocks the mystery of energy spectrum and entanglement spectrum.

Editors:

Dr. Kai-Ming Lee
Prof. Shizhong Zhang (acting)

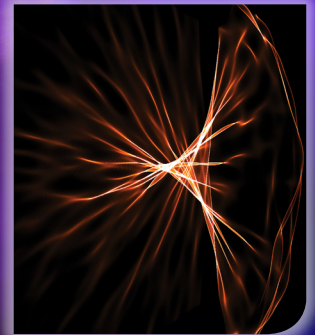


<https://www.physics.hku.hk/>

Promotions, Awards, Research Highlights and Conference

For the first time, they developed efficient quantum Monte Carlo computation scheme of ES in two and higher dimensions quantum systems. Moreover, their wormhole picture offers a general conclusion beyond the Li-Haldane's conjecture – the conjecture only works on the topological systems with gapped bulk and gapless edge, but the wormhole effect is valid for any system, independent of gap/gapless and dimension. They explain the long-standing problem of the relation between the entanglement spectrum and energy spectrum of quantum many-body systems. Their work will certainly trigger future investigations on the fast-growing frontiers of quantum information and condensed matter physics.

- Alfred Amruth, a PhD student of Dr. Jeremy Jin Leong Lim, is the first author of the paper “Einstein rings modulated by wavelike dark matter from anomalies in gravitationally lensed images”, published in Nature Astronomy. It is selected as the front cover photo (attached) for the June issue. <https://www.nature.com/natastron/volumes/7> It is now rated as within the top 1% of all research papers published in all journals in terms of how much media attention it created.
- Alfred Amruth was awarded the Dissertation Year Fellowship (DYF) as a result of his PhD thesis being rated by the examiners as excellent (within the top 5% of all theses submitted).



- Dr. Jeremy Jin Leong Lim and Alfred Amruth were awarded the RGC Germany-HK Joint Research Scheme grant to visit and collaborate with leading researchers at the University of Heidelberg.
- Dr. Jane Dai and Dr. Stephen Ng organised an international conference on astrophysical black holes at HKU in June 2023. About 100 researchers joined the conference, including various Prize Laureates and leaders of international astronomical missions. <https://astrobh.physics.hku.hk/event/3/>

Research Opportunities for High School Students

High school students write to Dr. Lim for research opportunities over the summer. After vetting the students to understand their intentions, and explaining to them the time commitment needed even for a cursory introduction to research, Dr. Lim sets them specific tasks as part of the research effort conducted in his team. Over the past summer, three high-school students, two from Hong Kong and one from Guangzhou, analysed images from the Hubble Space Telescope to search for star formation in the giant elliptical galaxies that reside at the centres of galaxy clusters. The high-school student from Guangzhou, Ruixing Jiang, was so enthusiastic that he regularly travelled to HKU so as to participate in group meetings, during which students present the results of their research work.

Ruixing Jiang: It was really a pleasurable experience at HKU. The people I met, such as Arsen, Amruth, and Dr. Lim, were really supportive of students with very little research experience like me. Under their help, I was able to learn a lot about not only research skills in astronomy, but also how life in academia is like in general. I was also able to meet with fellow students keen on astronomy, and the friendship that we developed is really satisfying. I can't emphasize how much I enjoy the loving and caring atmosphere in the research group, and I hope more young astronomy enthusiasts like me could benefit from their experience at HKU!



Ariel Wong: Working with Dr Lim's research team at HKU has expanded my view on research in astrophysics. I have always been interested in pursuing this type of research, and this opportunity at HKU allowed me to learn all the basic skills with guidance from other students. Thank you to Arsen and Dr. Lim and the rest of the team for offering me insight that I wouldn't be able to get elsewhere.



Joshua Wong: Under the guidance of Dr. Lim and Arsen, I was able to gain a glimpse into the processes of research in astrophysics. This experience furthered my existing passion for this field, and reassured me that conducting research in this field is something I very much enjoy. Thank you so much to Arsen and Dr. Lim. I am very grateful for this experience and for your mentorship throughout it.