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Strongly correlated electrons in Sachdev-Ye-Kitaev models and twisted bilayer graphene

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List of Publications

1. “ Lyapunov exponents in a Sachdev-Ye-Kitaev-type model with population imbalance in the conformal limit and beyond ”,
A. S. Shankar, M.Fremling, S. Plugge and L. Fritz
Phys. Rev. D, 108, 094039 (2023).
2. “ Kondo effect in twisted bilayer graphene ”,
A. S. Shankar, D. O. Oriekhov, Andrew K. Mitchell, and L. Fritz
Phys. Rev. B, 107, 245102 (2023).

Curriculum Vitae

I was born on September 26th, 1996 in Chennai, a big city in the south of India. After finishing high school, I went to West Bengal for a five-year integrated Bachelor-Master program in Physics at the Indian Institute of Technology, Kharagpur.

During this period, I took courses in several areas of physics and engineering, including high energy physics and gravitational physics, with my favorite being condensed matter and statistical physics. I was also fortunate to get an early start at doing my own research by being selected for several internships throughout my bachelor and master studies. With Prof. Pinaki Sengupta at NTU Singapore, I worked on writing my first quantum Monte Carlo code to investigate the Heisenberg XXZ model on ladder-like systems. I then worked briefly with Prof. Barbara Terhal and Prof. Fabian Hassler on DMRG simulations at RTWH aachen, and then on numerical and analytical studies on the Anderson model on the Bethe lattice with Prof. Antonello Scardicchio at the ICTP, Trieste, looking for signatures of anomalous diffusion. I concluded my master studies with a thesis titled "Disordered Superconductors", working with Prof. Sudhansu Sekhar Mandal.

I started my PhD at Leiden university in the Quantum matter group of Prof. Jan Zaanen and Prof. Koenraad Schalm in August 2019. After a short stint there, I moved to the group of Prof. Vadim Cheianov in April 2021. It was also at this time that I started working very closely with Prof. Lars Fritz and his group at Utrecht University.

As the early years of my PhD programme were marred by the coronavirus pandemic, I attended several condensed matter schools online, including editions of the Princeton PSSC summer school and the Maglab winter school. After the pandemic ended, I was able to present my work at several schools and conferences, including poster presentations in Trieste, Italy, at the ICTP conference "From quantum criticality to flat bands", at the school "Emergence of quantum phases in novel materials", at CSIC, Madrid, Spain, at the Veldhoven Physics conference in the Netherlands, and an online talk at the APS March meeting in 2023, among others. I also had the opportunity to TA several undergraduate and graduate courses, in particular to write a set of extensive lecture notes on Information Geometry with Prof. Subodh Patil.

After the defense of my PhD, I will move on to begin a Postdoctoral position at the International Center for Theoretical Physics (ICTP) in Trieste, Italy.

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First and foremost, I would like to thank my promotors Prof. Vadim Cheianov and Prof. Koenraad Schalm for giving me the independence to carve my own path, even though it might have been slightly unconventional. I'm very thankful to Vadim for his infinite patience with my questions and for addressing them sincerely even if they might have been trivial at times. To Koenraad I'm thankful for teaching me to improve my scientific rigor and for the importance he taught me to place on communicating my results well. Thank you very much.

I'm most greatly indebted to Prof. Lars Fritz, his contribution to this work goes far beyond his supervision of the two published papers that form parts of this thesis. I'm exceedingly grateful to him for welcoming me into his group, and for his wonderful mentorship over the years. I'm also thankful to Lars for introducing me to Prof. Andrew K. Mitchell, who I greatly enjoyed collaborating with. I hope this collaboration will last for quite some time to come.

I'm also very grateful to the PhD students and postdocs that I worked with in Leiden and in Utrecht - Dima Oriekhov, Mikael Fremling and Stephan Plugge. I am also particularly grateful to the several intense discussions I had with Nicolas Chagnet over physics and on numerics in general. I would also like to acknowledge master students Alina Melissakis and Nina Doerfler whose theses I helped co-supervise- I learned quite a lot from this experience.

I extend thanks next to the several friends I made along the way. I will always have a special place for my covid-housemate Alicja Dutkiewicz, and my post-covid housemate Dimitrios Krommydas, with whom I felt that family was always close by.

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