Дополнительные главы квантовой механики

Lecturers:
Иван Иорш

Language:
English

Credit points:
3 з.е.

Monitoring type:
Экзамен

Educational Program:
Нанофотоника
1, 3 семестры
Квантовые материалы
1, 3 семестры
Гибридные материалы
1, 3 семестры
Компьютерное моделирование квантовых и нанофотонных систем
1, 3 семестры

Lectures (a.h)*	Practice (a.h)	Labs (a.h)
32		
*1 academic hour = 45 minutes		

В данном курсе студенты смогут применить свои навыки и знания в квантовой механике, делая свои проекты в течение семестра под научным руководством преподавателя.

Course content

Plan of a course

Структура курса

Topics for seminars

1. Matrix product states
2. Kitaev honeycomb model
3. Foundations of quantum mechanics. EPR paradox, Bell’s theorem and PBR theorem
4. Fractional Quantum Hall effect
5. Weak localization
6. The Berezinskii-Kosterlitz-Thouless topological phase transition
7. Kitaev chain
8. Quantum spin liquids. Resonating valence bonds, non-local excitations
9. The Sherrington-Kirkpatrick Model. Exact solution, replica method, spin glasses

Recommended resources

Literature

1. Orus, R. (2013). A Practical Introduction to Tensor Networks: Matrix Product States and Projected Entangled Pair States. https://doi.org/10.1016/j.aop.2014.06.013
2. Zschocke, F. (2016). Kitaev honeycomb model. Majorana fermion representation and disorder. https://inis.iaea.org/search/search.aspx?orig_q=RN:47097465
3. Kitaev, A. (2008). Anyons in an exactly solved model and beyond.
4. Sachdev, S. (2011). Quantum Phase Transitions. Cambridge University Press. https://doi.org/10.1017/CBO9780511973765
5. Wen, X. (2007). Quantum Field Theory of Many-Body Systems: From the Origin of Sound to an Origin of Light and Electrons. Oxford University Press. https://oxford.universitypressscholarship.com/view/10.1093/acprof:oso/9780199227259.001.0001/acprof-9780199227259
6. Adlam, E. (2021). Foundations of Quantum Mechanics. In Elements in the Philosophy of Physics. Cambridge University Press. https://doi.org/10.1017/9781108885515
7. Tong, D. (2016). The Quantum Hall Effect TIFR Infosys Lectures. http://www.damtp.cam.ac.uk/user/tong/qhe.html
8. Datta, S. (1995). Electronic Transport in Mesoscopic Systems. Cambridge University Press. https://doi.org/10.1017/CBO9780511805776
9. Patashinski A. & Pokrovskii, V. (1979). Fluctuation Theory of phase transitions.
10. Chhajed, K. (2021). From Ising Model to Kitaev Chain. https://doi.org/10.1007/s12045-021-1261-6
11. Balents, L. (2016). Reports on Progress in Physics Quantum spin liquids: a review. (2016). https://doi.org/10.1088/0034-4885/80/1/016502
12. Sachdev, S. (2012). The quantum phases of matter. https://doi.org/10.48550/arXiv.1203.4565
13. Panchenko, D. (2012). The Sherrington-Kirkpatrick Model: An Overview. https://doi.org/10.1007/s10955-012-0586-7