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ICFO COLLOQUIUM DMITRY ABANIN 'Non-Equilibrium Quantum Many-Body Physics through the Prism of Entanglement'

DMITRY ABANIN

May 03, 2019

Friday, May 3, 2019, 12:00. ICFO Auditorium

DMITRY ABANIN

Professor of Physics, University of Geneva | UNIGE $$Dmitry Abanin is an expert in theoretical quantum many-body physics. He obtained his PhD in 2008 from MIT, working on quantum transport and strongly correlated phenomena in graphene and other two-dimensional materials. After postdoctoral fellowships at Princeton and Harvard University, in 2012 he became an assistant professor at the Perimeter Institute for Theoretical Physics and the Institute of Quantum Computing in Waterloo, Canada. Since 2015, he has been a professor of physics at the University of Geneva, Switzerland. Abanin?s research interests include, in

particular, non-equilibrium phenomena in solids and synthetic systems such as cold atoms. He has been developing theoretical description of non-equilibrium quantum matter beyond conventional statistical mechanics, by using insights and techniques from quantum information, condensed matter, and mathematical physics. He is also interested in using driving as a tool to manipulate quantum matter and realize collective states with novel properties and functionalities.

The experimental advances in synthetic quantum systems allow one to probe quantum thermalization and its breakdown. Thermalization occurs in ergodic systems and "erases" quantum information contained in the initial many-body states. Therefore, to create long-lived quantum states, it is of particular interest to find mechanisms of thermalization breakdown. One way of suppressing thermalization is by introducing quenched disorder, which may induce many-body localization (MBL). Surprisingly, MBL systems may also avoid heating under periodic driving, which opens up the possibility of having stable, Floquet-MBL phases with unusual properties. I will discuss one recent example of such a phase - a two-dimensional Anomalous Floquet Insulator, characterized by fully localized bulk states and chiral, thermalizing edge states. I will discuss another example of a non-trivial Floquet phase - the critical time crystals, which have recently been observed in driven systems of interacting, coherent NV-spins in black diamond. Further, I will argue that MBL may not be the only way to break ergodicity. I will propose another mechanism, "quantum many-body scarring", which bears a similarity to the well-known phenomenon of quantum scars in few-body chaos, and leads to a weaker form of ergodicity breaking in a many-body system of Rydberg atoms.

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