Seminar announcement

Monday, June 3, 2024
4 pm
WSI, Seminar room S 101
Exclusively in person

"Linear, nonlinear, and quantum optics of topological materials"

There are numerous examples of condensed matter systems with electron states that have a nontrivial topology in the Brillouin zone. This gives rise to highly unusual transport and optical response. While most studies have focused on the band structure and electron transport, the optical properties of topological materials are no less exciting. Optical spectroscopy can provide a cleaner and more straightforward way of studying the topological properties of electron states compared to transport measurements. Moreover, the unusual optical properties of these materials can be utilized in future optoelectronic devices. I will discuss several examples illustrating these points.

I will start from graphene, which is not a topological system but it provides important insights into the optical response of 2D relativistic Dirac fermions. We will then proceed with their 3D implementation in Weyl semimetals and nodal ring semimetals. Linear, nonlinear, and magneto-optical effects will be considered. We will also discuss surface effects due to Fermi arc surface electron states and the optical detection of the chiral anomaly. Finally, we will return to 2D systems and explore the possibility of coherent optical control of quantum Hall edge states. Throughout the talk, we will point out several possibilities for novel optoelectronic and quantum optical devices.

Bio: Alexey Belyanin received his PhD in Physics from the Russian Academy of Sciences in 1995. Currently he is a professor of Physics and holds the Ed Rachal Chair at Texas A&M University. He coauthored over 170 papers in refereed journals and holds 5 patents. He has served as chair of international conferences and has received a number of awards for research. He is a Fellow of the American Physical Society, Optical Society of America (Optica), and International Society for Optics and Photonics (SPIE). His current research focuses on ultrafast, nonlinear, and quantum optics of semiconductor nanostructures and novel materials, optical properties of topological materials, nanophotonics and quantum information, and the development of new optoelectronic devices.

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