Mathematics Colloquium

University of Texas at Arlington - Department of Mathematics
Proudly Presents:

Dr. Bojko Bakalov

North Carolina State University

Friday, November 1st, 2024
2:00 pm – 3:00 pm
PKH 311

"Dynamic Lie Algebras"

Abstract:

Quantum computers are physical machines that process information using the principles of quantum mechanics, which in turn is underpinned by linear algebra. The talk will start with a review of Lie algebras (consisting of matrices under the operation of commutator) and their role in quantum mechanics. The dynamical Lie algebra (DLA) of a quantum system is defined as the Lie algebra obtained by taking all real linear combinations and nested commutators of the terms of the Hamiltonian. The significance of the DLA is that the time evolution of the system is given by elements of the associated Lie group. The DLA determines the set of reachable states of the system and its controllability, so it is relevant for designing quantum circuits. In this talk, I will present a classification of DLAs generated by 2-local Pauli interactions on spin chains and on arbitrary interaction graphs. I will also discuss applications of DLAs to variational quantum computing, including the problem of barren plateaus. The talk will be accessible to all mathematics graduate students; no prior knowledge of physics or quantum computing is assumed.

Bio:

Originally from Bulgaria, Bojko Bakalov received his PhD from MIT and was a Miller Research Fellow at UC Berkeley before joining the NC State Math Department in 2003. Currently, he is the Director of Graduate Programs in Math and Applied Math and has a leadership role in the NC State Quantum Initiative. Bakalov's research interests include representation theory, quantum computing, mathematical physics, signal processing, and integrable systems. In 2006, he was awarded the Hermann Weyl Prize of the International Colloquia on Group Theoretical Methods in Physics, for original work of significant scientific quality in the area of understanding physics through symmetries. Bakalov's research has been funded by the US Air Force, DOE, NSA, NSF, and the Simons Foundation.

Refreshments before the talk and socializing following the talk
http://www.uta.edu/math/seminars