Attachment

RGC Research Fellow Scheme

Professor Jonathan Choi Chung-hang, Associate Professor, Department of Biomedical Engineering
Project title: Preclinical Translation of Spherical Nucleic Acid Nanostructures for Managing Cardiovascular Diseases

Atherosclerosis underpins the progression of stroke and myocardial infarction, both leading causes of death globally. Gene regulation is an emerging therapeutic approach to cardiovascular diseases, but methods for gene delivery to the plaques are inefficient. Professor Choi's team bypassed this obstacle by assembling a spherical nucleic acid nanostructure using anti-inflammatory microRNA oligonucleotides. In mouse disease models, this nanostructure not only naturally targets the scavenger receptors on plaque macrophages and endothelial cells to achieve plaque delivery and transfection agent-free cellular entry of miRNA, but also reduces plaques without inducing severe toxicity. Professor Choi aims to elevate the biomedical impact of microRNA nanostructures to manage cardiovascular diseases in large animals, including plaque-bearing rabbit models and pig models with myocardial infarction. This project will offer important insights into the bio-nano interactions, efficacy and safety of nucleic acid nanostructures for clinical translation.

Professor Gao Zhenyu, Associate Professor, Department of Finance
Project title: In Response to Climate Change: Beliefs and Actions of Governments, Individuals, Institutions, and Corporations
(No content)

Professor Gu Zhengcheng, Associate Professor, Department of Physics
Project title: Topological Phase Transition and Quantum Criticality: Beyond Landau's Paradigm

The Landau symmetry-breaking theory was once widely regarded as the comprehensive framework for describing all possible orders and continuous phase transitions. However, in recent years, significant progress has been made in the study of topological phases of quantum matter, challenging this belief. Professor Gu and his team's research focuses on using categorical symmetry and the holographic principle to gain insights into topological phase transitions in higher dimensions, especially in interacting fermion systems.

Through tensor network simulations, they will explore new universality classes of topological phase transitions and deconfined quantum critical points (DQCPs) in realistic systems. Simultaneously, they will search for experimental evidence of topological phase transitions or DQCPs, examining their potential implications in fundamental physics. By going beyond the traditional Landau paradigm, this project will uncover the true nature of topological phase transitions and DQCPs, making a profound and lasting impact on the fundamental research landscape in Hong Kong.

Professor Sun Xiankai, Associate Professor, Department of Electronic Engineering
Project title: Phononic Integrated Circuits for Next-generation Phononic-optoelectronic Integrated Chips

In an information society, the capability of information acquisition and processing is central to human life. Professor Sun's team aims to develop phononic integrated circuits on a silicon substrate, which enables phononic-optoelectronic integration for the next-generation integrated chips. This project will design all the phononic components and fabricate the phononic integrated circuits without suspended structures. For fundamental research, the developed area of integrated phononics will not only combine the traditional fields of nano-optomechanics and nanoelectromechanics, but also bring them to the level of integrated circuits, which can be used to explore the quantum properties of phonons and the interaction between phonons and other degrees of freedom on an integrated platform. For practical applications, the developed phononic integrated circuits will bridge the gap between today's integrated electronics and integrated photonics, provide cost-effective solutions for signal processing, and enable multifunctional sensing on a chip.