

## **Graduate Student Researcher (PhD) opportunity in Condensed Matter Physics.**

Newly organized laboratories at the University of Notre Dame, IN are looking for highly motivated young researchers to perform graduate level studies of novel two-dimensional materials and quantum devices.

The field of two-dimensional materials is a rapidly growing research topic in modern condensed matter physics. After original discovery of graphene, a diverse family of layered (van der Waals) materials has been experimentally realized, including semiconductors, semimetals, magnets and superconductors. A unique property of this new class of materials is an ability to stack them one upon another just like Lego blocks achieving novel electronic, optical and mechanical properties (*Nature* **499**, 419-425 (2013)). Recently, striking new properties have been engineered in twisted bilayer graphene, where adjacent graphene layers are rotationally faulted by the “magic” angle  $1.1^\circ$ . Energy hybridization between graphene layers leads to a formation of very flat electronic bands in the zero-energy limit, thus leading to the enhanced role of electron-electron interactions. As a result, amongst other exotic quantum phases (unconventional) superconductivity and orbital ferromagnetism have been reported, establishing twisted bilayer graphene as a highly tunable sandbox to test and explore strongly correlated phases of matter (*Nature* **556**, 43-50 (2018), *Nature* **556**, 80-84 (2018)).

The University of Notre Dame’s Department of Physics and Astronomy is a home to the newly organized Stavropoulos Center for Complex Quantum Matter. The central mission of our Center is to explore and exploit both fundamental and technological aspects of novel quantum materials. With the expertise ranging from quantum devices and quantum transport to the state-of-art scanning probe techniques, the Center is aiming to be the world leader in experimental and theoretical condensed matter research. Currently the Center includes following members:

Prof. **László Forró** - Director of the Center. Quantum transport, tunneling spectroscopy, high-pressure physics, organic superconductors.

Prof. **Xiaolong Liu** - Scanning tunneling microscopy, high-temperature superconductors, electron-pair density wave materials.

Prof. **Dafei Jin** - Electron transport, low temperature physics, single-electrons and single-photon quantum devices, superconducting qubits.

Prof. **Petr Stepanov** - 2D moiré materials, scanning near-field optical microscopy, quantum transport, twisted bilayer graphene, strongly correlated electrons.

The Center closely collaborates with all other members of Condensed Matter group at the Department (Badi H Assaf, Yi-Ting Hsu, Boldizsár Janko, Morten Eskildsen, Masaru Kuno, Xinyu Liu, Jeffrey Peng, Sylwia Ptasinska, Zoltán Toroczkai, and Dervis Vural).

We are looking for motivated students with a strong physics and condensed matter background, willing to learn and capable of finding solutions to challenging problems.

**Interested candidates should send their CV or any other requests about the graduate program to Petr Stepanov: [pstepano@nd.edu](mailto:pstepano@nd.edu). Application deadline: December 15th 2022.**

Notre Dame Physics’ graduate program info: <https://physics.nd.edu/graduate/>  
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