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## Sensing and thermoelectric applications of atomic monolayer materials

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Our nanotechnology research is directed toward quantum dots as elements of the THz and magnetic field nanosensors and efficient thermoelectric nanocoolers and energy generators based on atomic monolayer (AM) materials and nanotubes. Basic features of new materials are reflected in relativistic properties of low-energy excitations. The chirality and linear dispersion of electrons in graphene are pronounced in various experimentally observed eccentric properties, like unconventional quantum Hall effect, high mobility of charge carriers, etc. Our theoretical studies are focused on a.c. implications of Klein paradox and photon-assisted chiral tunneling in graphene and carbon nanotube junctions. When irradiating the G-FET to the external THz field, the resonant a.c. transport strongly depends on the polarity and magnitude of the source-drain and gate voltages. The resonant character of chiral tunneling and the low inelastic scattering rates serve as reasons why the a.c. current density can be much higher than in ordinary semiconducting devices. Another area of our interest is conversion of thermal energy into electricity in the electrically polarized graphene stripes with zigzag edges where the heavy chiral fermion (HCF) states are formed. The stripes are characterized by a high electric conductance  $G$  and by a significant Seebeck coefficient  $S$ . The electric current in the stripes is induced due to a non-equilibrium thermal injection of "hot" electrons. This thermoelectric generation process might be utilized for building of thermoelectric generators with an exceptionally high figure of merit  $Z\delta T \sim 100$  and with an appreciable electric power densities  $\sim 1 \text{ MW/cm}^2$ .

### Biography

Serhii Shafraniuk has completed his PhD at the age of 26 years from Kiev State University and postdoctoral studies from Academy of Sciences of Ukraine. He is the Research Associate Professor at Physics and Astronomy Department, Northwestern University, a premier educational and research institution. He has published more than 100 papers in reputed journals and serving as an organizer of various International Conferences.