Two part-time undergraduate summer research positions are open in the group of Prof. Misha Evstigneev. To apply, please email your letter of interest and unofficial transcripts to Dr. Evstigneev at mevstigneev@mun.ca before May 1, 2024.

Position 1: Anomalous diffusion. The textbook diffusion law says that the mean-square displacement of a Brownian particle increases linearly in time. Although a linear increase has been extensively studied theoretically and often observed experimentally, it is not generic.

Depending on the physical system, the mean-square displacement may increase in proportion to time raised to some power, which can be either greater than 1 (superdiffusion) or smaller than 1 (subdiffusion). Deviations from the standard diffusion law are termed anomalous diffusion.

In this project, various models exhibiting anomalous diffusion behaviour will be investigated using computer simulations and analytically. Of main interest will be the parameters that characterize free diffusion of the Brownian particle, its response to an external force and variations of temperature, as well as some counterintuitive types of behaviour, such as ratchet effect and negative mobility.

Position 2: Solar cell modeling. When sunlight enters a solar cell, it produces charge carriers that can either contribute to the output power or become lost due to a process known as recombination. What is the maximal electrical power we can realistically hope to obtain from a solar cell? The answer to this question depends on the intrinsic recombination mechanisms that cannot be controlled by technological means.

An important intrinsic mechanism is radiative recombination, in which the photogenerated charge carriers disappear with the emission of light quanta that eventually exit the cell. Fortunately, those light quanta can also be reabsorbed by the material and again produce charge carriers in a process known as photon recycling.

This project will be focused on the investigation of photon recycling in solar cells made of various materials and having different surface textures. The results obtained within this research will be relevant not only in solar cell technology, but also in the design of light-emitting diodes.