Dark matter constitutes approximately 80% of the total mass in the Universe and its nature is still unknown. A model proposed by Prof Zhitnitsky at UBC is that dark matter is made of composite objects called Axion Quark Nuggets (AQNs), that can form very early in the Universe. The AQNs interact with regular matter and this process can emit specific radiation (light), which spectrum and amplitude has been calculated in the case of a single AQN interacting with normal matter. The goal of the project is to calculate, and make predictions, of the AQN interaction with the baryonic content of astrophysical structures such as clusters and groups of galaxies, assuming AQN constitute most of dark matter. These calculations should demonstrate if the AQN signal could be detectable with current, or upcoming instruments, over a large range of wavelengths, from radio to Xray and gamma rays.
The student has to be comfortable with at least one programming language (python preferred). The project will involve the use of numerical integration techniques, and contains an astrophysics aspect with the modeling of the physical environment of galaxy clusters at various wavelengths and a physics aspect when implementing the AQN radiation spectrum in these real contexts.