MEMORIAL UNIVERSITY

Chemistry Departmental Seminar

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Thursday, June 20, 2024 at 1:00 p.m. (Room: CSF-1302)

Title: Manipulating Excitonic Properties of Plasmonic Semiconductor Nanocrystals

Abstract: Degenerately doped semiconductor nanocrystals with tunable localized surface plasmon resonance (LSPR) have attracted significant attention in recent years due to their unique optoelectronic properties. Unlike noble metal nanoparticles, colloidal plasmonic semiconductor nanocrystals have LSPR frequencies tunable in the infrared region, which makes them appealing for a range of applications, including terahertz imaging, heat-responsive devices, and surface-enhanced infrared spectroscopic measurements. These materials could also facilitate coupling between plasmonic and semiconducting properties, making them highly interesting for electronic and quantum information technologies. However, the LSPR and exciton transitions in semiconductor nanocrystals are generally not resonant, which has been a major obstacle toward realizing such opportunities. In this talk I will discuss the results of our recent work on the plasmonic properties of colloidal semiconductor nanostructures, and will particularly focus on magneto-optical studies of this class of materials. Using magnetic circular dichroism (MCD) spectroscopy we demonstrated robust excitonic Zeeman splitting in a range of plasmonic semiconductor nanocrystals enabled by the angular momentum associated with the cyclotron motion of free charge carriers in an external magnetic field. This phenomenon allows for a new way of realizing carrier polarization in semiconductor nanocrystals. Furthermore, the ability to control the type of charge carriers and the degree of their delocalization, as well as the nanocrystal size and morphology, allows for further manipulation of the exciton splitting pattern in semiconductor nanostructures. Possible applications of this emerging class of multifunctional materials for new electronic and quantum information technologies will also be discussed.

Biography: Pavle Radovanovic received his Ph.D. degree from the University of Washington, Seattle. Following his graduate studies, he carried out his postdoctoral research at Harvard University. He subsequently joined the faculty at the University of Waterloo, where he is now a Full Professor in the Department of Chemistry. Radovanovic's research program focuses on the design, synthesis, physical and chemical properties, and novel applications of multifunctional low-dimensional inorganic and hybrid materials. His work has been recognized by a number of honors and awards, including Research Excellence in Materials Chemistry and Keith Laidler Award (Canadian Society for Chemistry), Discovery Accelerator Supplement Award (NSERC), Tier 2 Canada Research Chair, Early Researcher Award (Ontario Ministry of Research and Innovation), and Mobility Award (French Ministry of Foreign Affairs). He is an elected Fellow of the

International Association of Advanced Materials, and was a Visiting Professor at the University of California-Berkeley.