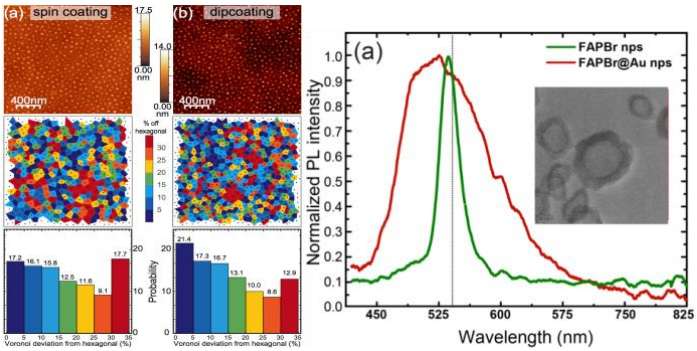
Undergraduate research opportunity (Summer 2023/Fall 2023/Winter 2024)
Organo-halide perovskite based lasers for optical communications
Department of Physics, Concordia University, Montreal Canada
Centre for NanoScience Research (CeNSR)

The Turak Functional Nanomaterials Laboratory seeks to revolutionize optoelectronics by making them cheaper, more accessible, and more flexible. Our research focusses on developing easy, versatile, and inexpensive methods of exploring and tuning surfaces using nanoparticle functionalization. To achieve this vision, the Turak group uses simple manufacturing approaches (reverse micelle deposition), allows nature to dictate morphology (entropic self-assembly, beneficial dewetting), and develops characterization tools that are widely applicable to nanotechnology.



M. Munir, Turak *et al.*, *2021 Photonics North* PN52152, 9597948.

Although mid-IR wavelength (3-5 um and 8-12 um) emitters are essential for practical all-weather optical satellite communications, such lasers with high optical power (~1 W) and high bit rate (>1 Gb/s) are not available on the market. Solid-state perovskites represent a new approach to achieving high lasing with strikingly low thresholds due to their large absorption, low bulk defect densities and slow Auger recombination, within a solution-cast laser. However, heterogeneity is currently one of the key roadblocks in the development of nanoparticle-based lasers, and most losses in perovskite devices result from inhomogeneous films and interfaces. As a critical problem for perovskites lasers is stability and heat dissipation, micelle templated core-shell nanoparticles have been developed to protect the perovskites and boost their performance.

In the proposed project, the student will explore various core-shell combinations to assess their impact on the temperature stability of perovskite emission. They will responsible for analyzing the nanoparticle size, distribution and optical properties on various substrates using atomic force microscopy, and UV/Visible and photoluminescence spectroscopy. They will work in collaboration with other team members to analyze the results from SEM, Raman and XPS to confirm structure and emission behaviour.

Students interested in paid (USRA, CURSA, Physics URA, FRQS Awards for Undergraduate Introduction to Research), for class credit (Honors thesis or research experience) or volunteer internships from Physics, Chemistry, Chemical and Materials Engineering, or related areas are welcome to apply.

To apply, please send a letter of interest, CV and contact information for two references in a single pdf document, with email subject **"Turak Lab Project Applicant"**. Only applicants considered for employment will be contacted for an interview. **All applications should be sent to Ayse Turak (ayse.turak@concordia.ca)**