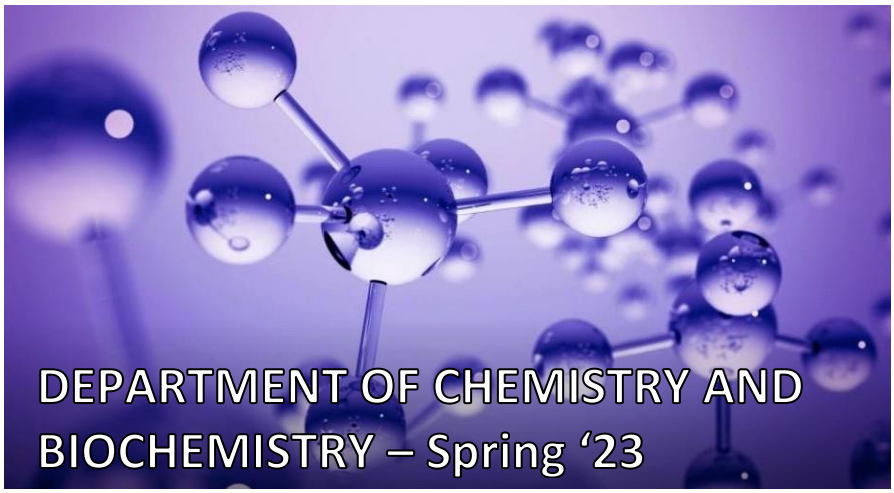

THE SALZBERG CHEMISTRY SEMINAR SERIES

The City College of New York

CREST IDEALS PHASE II

Monday, May 8, 2023 @ 12:00 noon – MR1027

Quantum optoelectronics with two-dimensional materials

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Abstract: Photonics based on two-dimensional (2D) materials has made great progress in the last decade, and currently sets the state of the art in several emerging fields, including photonics and optoelectronics. Recently, the demonstration of stable single-photon emitters in semiconductor transition metal dichalcogenides (TMDs) and hexagonal boron nitride (hBN) opened exciting new perspectives in quantum optics. This colloquium will focus on the photonic applications enabled by excitons and quantum emitters in 2D materials.

In the first part of the talk, I will discuss the properties of excitons in 2D materials, and I will present our recent results on the visualization and diffusion of dark states in TMDs. Dark excitonic states do not typically couple with light, but in TMDs they represent the lowest excitonic states of the system. Therefore, it is crucial to create conditions in which these excitonic states can be visualized. Our experiments show that the emission and spectral properties of dark excitons can be controlled, and they provide a new tool for the transport of quantum information. Finally, I will discuss new ways to engineer light-matter interactions in 2D materials via atomic manipulation.

In the second part of the talk, I will focus on the quantum emission from atom-like defects in 2D hBN with particular attention to the origin of their broad inhomogeneous spectral distribution. Our experiments were able to link this multicolor emission to variations of the electromagnetic environment with the development of a method to actively tune the emission energy by externally modifying strain. Recently, a deeper understating of the atomic origin of these quantum emitters has emerged from the combination of photoluminescence and X-ray inelastic scattering experimental techniques.

Biography: Gabriele Grosso is an Assistant Professor of Physics at the Advanced Science Research Center and at the Graduate Center of CUNY. He received his BS and MS in Physics from the University of Padova in 2007 and 2010, respectively. During his Master, he was a visiting researcher at the University of California San Diego. In 2014, he completed his Ph.D. in physics for his work on polariton quantum fluids at the École Polytechnique Fédérale de Lausanne (EPFL). He then joined the Quantum Photonics Group at the Massachusetts Institute of Technology as a postdoc. Gabriele was a fellow of the Swiss National Science Foundation from 2014 to 2017, and the recipient of the NSF CAREER award in 2021. His current research focuses on quantum technologies based on light-matter interactions in two-dimensional van der Waals materials and other quantum confined systems.

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