VISTA Seminar

Seminar 24

September 30, 2021

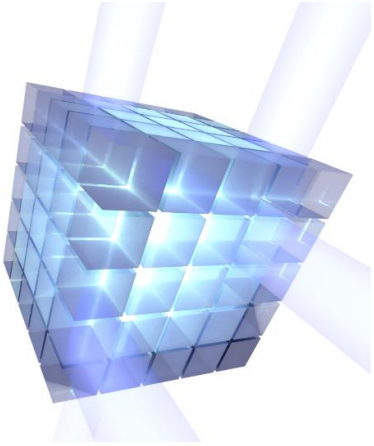
10:00 am – 11:30 am EDT / 2:00 – 3:30 pm GMT / 4:00 pm – 5:30 pm Paris

TOC:

Perovskite Nanocrystals as Non-Classical Light Sources: From Single Photon Emission to Superfluorescence

Gabriele Rainò

[1]*Institute of Inorganic Chemistry, Department of Chemistry and Applied Bioscience, ETH Zurich, 8093 Zurich, Switzerland.*
[2]*Laboratory of Thin Films and Photovoltaics, Empa – Swiss Federal Laboratories for Materials Science and Technology, 8600 Dübendorf, Switzerland.*
e-mail: rainog@ethz.ch



Gabriele Rainò (rainog@ethz.ch) received the PhD degree in Innovative Materials and Technologies from the University of Salento in 2008. In 2008 he joined IBM Research - Zurich as a postdoc, working on organic-inorganic nanomaterials for integrated photonics. In 2011, he became a junior researcher at IBM Research - Zurich and started the exploration of colloidal nanomaterials as non-classical light sources for quantum sensing applications. Since spring 2017, he has joined, as senior research fellow, the group of Prof. Kovalenko, continuing the exploration of colloidal nanomaterials for optoelectronics and quantum applications.

Besides conventional optoelectronic devices (LEDs and laser), colloidal nanocrystals (NCs) are pursued as non-classical light sources (i.e. single photon emitters) that might play a pivotal role in future quantum technologies, such as quantum cryptography and quantum sensing.

Due to strongly reduced charge trapping on surface states and their defect-tolerant character, perovskite NCs become attractive as alternative quantum light sources. Indeed, very stable, blinking-free emission[1] has been observed at cryogenic temperatures with ultrafast radiative lifetime[2] and long exciton dephasing time[3]. In addition, when organized in highly-ordered three-dimensional superlattices, perovskite NCs exhibit superfluorescence (SF)[4,5], a cooperative emission of individual emitters that arises due to a coherent collective coupling to a common light field.

The talk will review our recent achievements in the exploration of perovskite NCs as non-classical light sources and future developments.

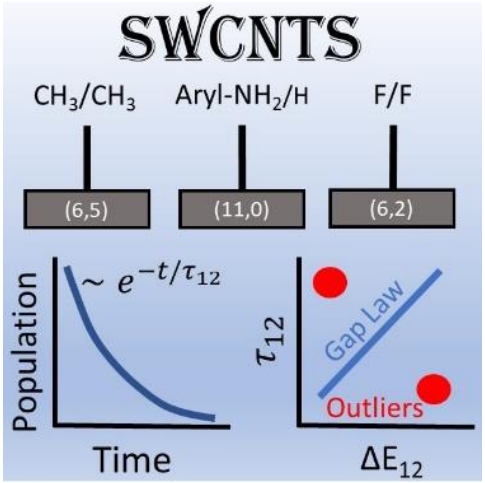
References:

[1] G. Rainò *et al.*, *ACS Nano* (2016), 10, 2485–2490.
[2] M. Becker *et al.*, *Nature* (2018), 553, 189–193.
[3] M. Becker *et al.*, *Nanoletters* (2018), 7546–7551.
[4] G. Rainò *et al.*, *Nature* (2018), 563, 671–675.
[5] I. Cherniukh *et al.*, *Nature* (2021), 593, 535–542.

Non-adiabatic Dynamics Simulations of Single-Walled Carbon Nanotubes with Topological sp^3-defects: An On-the-fly NEXMD Study

Braden M. Weight[1,2], Andrew E. Sifain[3], Brendan J. Gifford[2], and Sergei Tretiak[2]

[1]*Department of Physics and Astronomy, University of Rochester, Rochester, NY 14627, U.S.A*
[2]*Center for Integrated Nanotechnologies, Center for Nonlinear Studies, and Theoretical Division Los Alamos National Laboratory, Los Alamos, NM 87545, U.S.A.*
[3]*Department of Chemistry, Princeton University, Princeton, NJ 08540 U.S.A.*



Single walled carbon nanotubes (SWCNTs) with covalent surface defects have been well-explored over the last few years, and these systems have shown promise for use in single-photon telecommunication emission as well as in spintronic applications. The dynamical evolution of excitons in these systems has only been loosely discussed in the theoretical literature due to the size limitation of these large systems (# Atoms > 300). Herein, we present an application of an open-source framework, Non-adiabatic EXcited state Molecular Dynamics (NEXMD), to perform a set of fewest switches surface hopping (FSSH) calculations in the excitonic picture using a semi-empirical Hamiltonian on a variety of SWCNT chiralities as well as single-defect functionalizations. We find a strong chirality and defect-composition dependence on the population relaxation between the pristine E_{11} state and the defect-associated, single-photon-emitting S_1 state and gives insight into the dynamic trapping nature of these localized excitonic states. Engineering fast population decay into the quasi-two-level sub-system $\{S_0, S_1\}$ with weak coherence to higher-energy states increases the effectiveness and controllability of these novel quantum light emitters.

How to connect

Alexey Akimov is inviting you to a scheduled Zoom meeting.

Topic: VISTA, Seminar 24
Time: Sep 30, 2021 10:00 AM Eastern Time (US and Canada)

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