

MIT Chemical Engineering Department

Spring 2019 Seminar Series

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Controlling Nanoscale Transport for Next Generation Solutions



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4:15pm (Reception at 4:00pm)
66-110

Abstract: Controlling the transport of excitons, charge, and spin at the nanoscale has opened up numerous exciting opportunities. In particular, transport between different material systems has allowed us to uncover novel physics and applications. In this talk, I will show how we can use this control to build the next generation of solutions to the challenges facing us.

First, photon upconversion and downconversion allow us to convert between colors of light while conserving energy. We demonstrate that controlling exciton flow between organics and colloidal nanocrystals allows us to achieve quantum efficiencies greater than 100% utilizing downconversion and infrared-to-visible harvesting using upconversion. Further, by pairing upconversion with a photocatalyst, we can perform photochemistry using infrared light instead of visible, opening the door for *in vivo* applications.

Similar opportunities can be found in perovskites: these materials have great potential, but poor stability and the low quality of blue emitters limit commercialization opportunities. Here, we show that controlling the exciton and charge transfer between an atomic dopant and the perovskite host allows for greatly improved luminescence and stability, providing an important step towards commercializing perovskite devices.