



Chemistry and Biochemistry

Fall 2021 Zoom Seminar

Please join us for the following seminar!

Nanoscale Control of Light and Energy

Speaker:

Dan Congreve,
Assistant Professor



When:

Friday, October 8
1:00 pm

Where:

On Zoom
bit.ly/chicochem

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Modern nano-materials offer an almost infinite application space, with huge advances made recently in fields as varied as solar cells and LEDs to 3D printing and optogenetics. In particular, combining different material systems has allowed us to uncover novel and exciting physics and applications. In this talk, I will discuss nano-material breakthroughs across several fields, with a particular focus on blue perovskite LEDs and applications of photon upconversion and downconversion.

Perovskite LEDs are an exploding field, with high performance red and green devices demonstrated by many groups. Blue LEDs, however, have lagging significantly behind. Here, we identify two crucial issues holding these materials back: the low internal photoluminescence yield and the LED device structure itself. By rectifying these issues, we were able to build LEDs that were 60x brighter than control, competitive with their red and green cousins.

Photon upconversion and downconversion allows us to convert between colors of light while conserving energy. We demonstrate that these processes allow for huge advancements in photovoltaic technology by circumventing the Shockley-Queisser Limit, achieving quantum efficiencies greater than 100% utilizing downconversion and infrared-to-visible harvesting using upconversion. Further, using nanoscale encapsulation to add upconversion to a 3D printing resin, we can circumvent the layer-by-layer nature of traditional 3D printing and print in a truly volumetric fashion.