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SEMINAR SERIES

Wednesday, March 13th, 2024
Seminar Presentation: 11:00am – 12:00pm
SME room 248

"DNA as an architect for atomically precise silver nanoclusters"

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Abstract: DNA is a programmable building block for sequence-encoded nanomaterials whose structure-property relationships are governed by Nature's base pairing rules. By exploiting metal-nucleic acid chemistry, we can significantly expand the "sequence-structure-property" relationships of DNA-based nanomaterials beyond the rules that Nature provides. This talk focuses on one such promising direction: atomically precise and programmable DNA-templated metal nanoclusters with bright fluorescence and promise for addressing challenges in biophotonics. DNA oligomers can template atomically precise silver nanoclusters (Ag-DNAs) that come in a diversity of bright, sequence-selected fluorescence colors. While Ag-DNAs hold promise for bioimaging and biosensing, their structure-property relationships have remained elusive. By combining high-throughput experiments and machine learning models with analytical studies of single nanocluster species, we show how nucleobase sequence selects the structures and colors of Ag-DNAs. This approach enables the design of new DNA template sequences for Ag-DNAs that emit light in the near-infrared tissue transparency window, a key area of need for bioimaging. Finally, I will discuss how we are using native mass spectrometry and circular dichroism spectroscopy to advance understanding of Ag-DNA ligand chemistry. Our discovery of a new class of Ag-DNAs with halide ligands has recently enabled the first electronic structure calculations for Ag-DNAs and presents new opportunities to expand these emitters for biophotonics applications.

Biosketch: Stacy Copp is an Assistant Professor of Materials Science and Engineering at the University of California, Irvine, with joint appointments in Physics and Chemical and Biomolecular Engineering. Copp received a B.S. in Physics and Mathematics from the University of Arizona (2011) and a PhD in Physics from UC Santa Barbara (2016). She held a Hoffman Distinguished Postdoctoral Fellowship and L'Oreal USA for Women in Science Fellowship at Los Alamos National Laboratory, before joining UC Irvine in 2019. At UC Irvine, she leads the Molecular Nanomaterials Lab, whose mission is to harness DNA and synthetic block polymers as programmable building blocks for nanoscale materials. Copp has pioneered machine learning approaches to DNA nanomaterials design, including the discovery of DNA-templated silver nanoclusters with sequence-selected atomic sizes and fluorescence colors. Her research has been recognized by recent awards such as the Hellman Faculty Fellowship, Air Force Office of Scientific Research Young Investigator Award, UC Irvine School of Engineering Early Career Research Excellence Award, and the Samueli Faculty Development Chair.