Modern image sensors consist of systems of cascaded and bulky spherical optics for imaging with minimal aberrations. While these systems provide high quality images, the improved functionality comes at the cost of increased size and weight. One route to reduce a system’s complexity is via computational imaging, in which much of the aberration correction and functionality of the optical hardware is shifted to post-processing in the software realm. Alternatively, a designer could miniaturize the optics by replacing them with diffractive optical elements, which mimic the functionality of refractive systems in a more compact form factor. Metasurfaces are an extreme example of such diffractive elements, in which quasiperiodic arrays of resonant subwavelength optical antennas impart spatially-varying changes on a wavefront. While separately both computational imaging and metasurfaces are promising avenues toward simplifying optical systems, a synergistic combination of these fields can further enhance system performance and facilitate advanced capabilities. In this talk, I will present a method to combine these two techniques to perform full-color imaging across the whole visible spectrum [1]. I will also discuss the use of computational techniques to design new metasurfaces [2], and using metasurfaces to perform computation on wavefronts, with applications in optical information processing and sensing.

References:
