Considering Polarimeters as Channeled Information Systems

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Polarization imaging has emerged over the past three decades as a powerful complementary imaging tool for a range of sensing applications ranging from astronomy to medical imaging to military sensing. Polarization carries information about the geometric scattering interactions between light and an object, and polarization data provide details about object orientation, surface roughness, and material composition. For most of the history of imaging polarization, polarimeters have been considered as zero-bandwidth devices using a linear algebraic formalism. Over the past several years, our group has worked on new descriptions of polarimeters that describe the devices as channeled information systems. Since optical detectors are essentially polarization-blind, the polarization details of the field are modulated onto the intensity distribution in time, space, wavelength, or some combination of these domains. This modulation - which could be functional, periodic, random, etc., - creates channels that can then be demodulated to infer the desired polarization details.

This talk will be a two-part talk accessible to both the generalist and those with great interest in polarization. It will begin with an overview of polarimetry and several applications thereof. After motivating the collection of polarization data, the talk will shift to these new paradigms to discuss how to design modulation strategies that are tailored and optimized for measuring particular types of scenes.