Imaging Polarimetry in 2015

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The science and applications of polarimetry have exploded in the last decade. Polarimetry has progressed from being a niche field within optics to becoming a routine tool. Since polarimetry depends on the precise difference of highly accurate radiometric measurements, developments in the field were slow until better light sources, improved polarization elements, precision opto-mechanics, and high speed CCDs and detectors became available. Now the polarization economy is tens of billions of dollars per year, led by displays, semiconductor testing, and biomedical applications. The average home contains dozens of polarization elements, which except for sunglasses, are unbeknownst to most citizens.

In the Optical Sciences programs I am associated with at the University of Arizona and Utsunomiya University, students are exposed to polarization in more than a two dozen classes in optical testing, electromagnetics, physical optics, quantum optics, thin films, and lens design. The demand for polarization expertise in our graduates has never been higher. Similar stories abound from other Universities.

The new Daniel K. Inoue Solar Telescope under construction in Hawaii, soon to be the largest solar telescope in the world, contains five spectropolarimeters with specifications pushing the state of the art in polarization element fabrication and calibration. Polarimetry is central to the fusion diagnostics being incorporated into the International Thermonuclear Experimental Reactor (ITER) under construction in Cadarache, France where measurements of the Motional Stark Effect provide information to control plasma instabilities. Microwave polarimetry is providing important constraints on cosmological models for the big bang. Polarimetry is emerging as a core technology for coronagraphs for the study of exoplanets, their atmospheres, and the formation of solar systems. At the ophthalmologist's office, laser polarimetry for retinal diagnostics for early glaucoma detection and other conditions has saved the vision of thousands.

This issue of *Kogaku* contains important contributions to the science of polarimetry by leading academic polarimetry researchers. Please enjoy.