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Planar Self-Similar Antennas for Broadband Millimeter-Wave Measurements

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From extremely broadband functionality to easily scalable designs, self-similar antennas offer a strong set of benefits. With a four-arm layout, self-similar designs also become geometrically suited for dual-polarization through excitations of opposing arms. However, there has only been limited use of these devices for millimeter-wave detectors. One field for such antennas is the Cosmic Microwave Background (CMB), which encompasses a wide frequency range and is now actively focusing more on polarization measurements.

We look at multiple planar self-similar antenna designs with simulations in HFSS (High Frequency Structure Simulator) and ongoing physical testing. They all exhibit broadband operation between 130-230 GHz and can couple to both linear polarizations through the previously mentioned four-arm symmetry. Simulations include each antenna design coupled to an extended, AR-coated lenslet. From these, a basic bowtie-like arm design produced high polarization efficiency and small frequency variation with moderate efficiency, while a hybrid trapezoidal design provides high efficiency with small polarization fluctuations. Current fabricated versions of each are being tested, coupled to multichroic Kinetic Inductance Detectors (mKIDs). These planar self similar antennas, when implemented in CMB and other detectors, could improve observations while simultaneously simplifying fabrication and detector layout designs.

Less than 5 years of experience since completion of Ph.D

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Student (Ph.D., M.Sc. or B.Sc.)

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Primary author: MEINKE, Jeremy (Arizona State University)

Co-authors: MAUSKOPF, Phillip (Arizona State University); Dr JOHNSON, Bradley (Columbia University); IRWIN, Kent (Stanford); LI, Dale (SLAC); Dr CHO, Hsiao-Mei (SLAC); Dr DAY, Peter (Jet Propulsion Laboratory); Prof. MCMAHON, Jeffrey (University of Michigan); Dr DOYLE, Simon (Cardiff University); ADE, Peter A. R. (Cardiff University)

Presenter: MEINKE, Jeremy (Arizona State University)

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