# An Improved Color Filter Array Design Using Metafilters

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Color image sensors typically rely on absorbing filters arranged in the Bayer pattern (red, 2×green, and blue). Dye-and pigment-based filter arrays have several disadvantages such as photo- and thermal- instability, a multi-step fabrication process, and reduced camera sensitivity from absorption. These disadvantages have motivated the investigation of alternatives to reduce fabrication cost and enhance camera sensitivity. Most approaches focus on structure-based filters. Here I present an alternative, structure-based CFA that combines dielectric phase plates and pillar-based metasurfaces. The CFAs were fabricated using two-photon lithography (Nanoscribe Photonic Professional GT) with IP-Dip resist. CFAs have metafilter sizes of 13.2 × 13.2 μm, a pillar periodicity of 1.2 μm, and a focal length of 18 μm. This design allows the zero and first order focal spots to be captured by separate pixels on the image sensor. The total efficiency of the sensor, which is close to 60% across much of the visible region, significantly exceeds most Bayer arrays. The current design also offers a flatter spectral response, which may be desirable under some lighting conditions.. The maximum color error of the filters is 5.5ΔE and the average error is 2.9ΔE in CIE xy coordinates. These results are comparable or better than the errors of common cellular phone and DSLR digital cameras.

**Awards Won:**

Fourth Award of $500