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# Combinatorial approach optimizes metamaterials

The combinatorial discovery approach, in which many slight variations on a desired entity (such as a device or material) are fabricated and then individually characterized to see if they are adequate for the job, has been very successful at finding new drugs and other chemical compounds. Now, researchers at the University of Southampton (Southampton, England), Sony (Tokyo, Japan), and National Taiwan University (Taipei, Taiwan) are using the same approach to discover better performing optical metamaterials. As a test, they applied the technique to metamaterials with so-called Fano resonances, which are very sensitive to small variations in geometry.

Many arrays of split-ring gold apertures (which serve as unit cells in many metamaterials) were fabricated, with unit-cell sizes ranging from 400 to 500 nm and other characteristics, such as gap-size and gap-position asymmetries, also serving as variables. The transmission and reflection of the arrays were measured in the 800 to 2000 nm spectral range. The researchers found that, in practice, a tradeoff between the narrowness of the resonances and the size of the asymmetries must be considered, and that trying to tune things too close to the theoretical optimum resulted in an overwhelming deleterious effect due to unavoidable imperfections. The resulting quantitative insights (versus merely qualitative for the conventional simulation approach) produced explicit recipes for better metamaterial design. *Contact Eric Plum at* erp@orc.soton.ac.uk.

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