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High-quality-factor metasurface for phase contrast imaging and spatial frequency filtering

Researchers at Stanford have developed an ultracompact, high-quality-factor (high-Q) metasurface that enables more convenient phase contrast imaging. Phase contrast imaging is a critical technique in biology and medicine to image essentially transparent objects such as cells. The technique is also gaining importance in the nanotechnology field. Conventionally, optical phase contrast imaging requires a set of components (annuli) placed in the Fourier plane of the imaging system. This increases the price of the imaging system and also requires tedious manual alignment. Overcoming these difficulties, the new high-Q metasurface can be used in any bright field microscope to achieve high-performance phase contrast imaging and more complex spatial frequency filtering. The optical system requires fewer, simpler parts and should be lower cost. It should also simplify alignment procedures.

Applications

- Live cell microscopy
- Nanofabricated sample examination
- In vivo retina imaging in ophthalmology

Advantages

- Greatly simplifies the microscopy system by eliminating the need to place filters in Fourier planes
- May significantly reduce the cost of phase contrast imaging
- Can lead to tunable contrast simply by changing the illumination wavelength or collection path polarizer (helpful when examining samples that have different

phase profiles)
- Sizable market

Patents

- Published Application: WO2021102331
- Published Application: 20220390656
- Issued: 12,487,387 (USA)

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