

BACK SCATTER

Nanopainted art

Dutch artist Johannes Vermeer painted *Girl with a Pearl Earring* around 1665. To mix his colors, Vermeer relied on pigments made of varying amounts of chalk, ochre, charcoal, and other materials. Pigments produce color through selective absorption, although color can also be made through the selective scattering of light waves by microscopically altered surfaces. Researchers have already produced several kinds of metasurfaces capable of generating a large color range. Now Nanjing University researchers Pengcheng Huo, Yanqing Lu, Ting Xu, and their colleagues have produced a metasurface that generates a full range of visible color on which they can simultaneously adjust the brightness.

As a proof of concept, the researchers reproduced Vermeer's masterpiece, shown here. They designed a dielectric metasurface composed of pillars hundreds of nanometers in size and made of titanium dioxide, a material with a high refractive index. When visible light falls on the metasurface, each nanopillar acts as a waveplate. At a specific wavelength, a nanopillar rotates the polarization of the light, which yields a color. The independently tunable orientation angle of each nanopillar relative to an applied electric field determines a color's brightness. Vermeer's original canvas measures about 1700 cm^2 . The nanopainted copy is approximately 0.65 mm^2 . (Image courtesy of Ting Xu; P. Huo et al., *Optica* 7, 1171, 2020.) —AL

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