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Plasmonic colouring of noble metals via picosecond laser pulses

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We report the creation of angle independent colors on silver due to plasmonic effects arising from random nanoparticle distributions induced by picosecond laser exposure. The color is determined by the total accumulated fluence on the surface. This is valid for all combinations of laser parameters producing the same total accumulated fluence. Both spectral and extra-spectral colors can be obtained. Finite-difference time-domain computations carried out on a high-performance computing system identify the role of each geometrical parameter leading to understanding of color formation. Absorptive plasmonic resonances in heterogeneous nanoclusters are found to be key in the color formation. We also simultaneously report the angle-independent coloring of pure gold with colors covering the entire spectral and extra-spectral region. To our knowledge this represents a world first in the laser coloring of metals.

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