Coding Metasurfaces for Diffuse Scattering: Theoretical Bounds and Sub-Optimal Design

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Coding metasurfaces, based on the combination of two basic unit cells with out-of-phase responses, have been the subject of many recent studies aimed at achieving *diffuse* scattering, with potential applications to diverse fields, including radar-signature control and computational imaging (Cui et al., Light Sci. Appl., 3**,** e218, 2014).

Here, via a theoretical study of the relevant scaling-laws, we elucidate the physical mechanism underlying the scattering-signature reduction, and we analytically derive some absolute and realistic bounds. Moreover, we introduce a simple, deterministic sub-optimal design strategy that yields results comparable with those typically obtained by approaches based on the brute-force numerical optimization, at a negligible fraction of their computational burden, thereby paving the way to the design of structures with *arbitrarily large* electrical size.

Our results are corroborated by both rigorous full-wave numerical simulations and microwave experiments, and may be of interest in a variety of application fields, such as the design of low-scattering targets and illumination apertures for computational imaging, not necessarily restricted to electromagnetic scenarios.