sections observed for rear-located particles on ultra-thin spacer layers to the type of resonant SPP modes excited at the Ag/substrate interface.

It is clear that for plasmonic particles, the excitation efficiency as well as the driving field needs to be optimised to achieve strong scattering in the vicinity of a high-index substrate, and this can be achieved by ensuring a large near-field overlap with the substrate.

6. Conclusion

We provide key physical insights into scattering from nanostructures on high-index substrates, beyond the dipole model. At short wavelengths, a dipole-like, free space resonance dominates, while at long wavelengths, the resonance can be attributed to the excitation of resonant surface plasmon polariton modes at the particle/substrate interface. These types of resonant modes have increased excitation efficiencies when the particle near-field overlaps significantly with the substrate. This can lead to very high scattering cross-sections for particles that support resonant SPP modes at the Ag/substrate interface; up to 7.5 times larger than that of a dipole with an equivalent free space resonance. This has implications for designing scattering nanostructures, namely that to ensure strong scattering and efficient coupling, especially from rear-located structures, there should be a large near field overlap with the substrate. Due to high scattering cross-sections and coupling efficiencies these modes have the potential to provide effective light trapping for photodetectors and photovoltaics devices.

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