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Optimizing light-matter interactions for Nano-Antennas

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We present a framework for understanding and predicting the different physical properties of light interacting with particles using multi-pole theoretical constructs like S and T matrices. Although these theoretical constructs have been around for a long time, recent progress in Weierstrass factorization in the context of quasi-normal mode analysis has cast new light on their analytical properties and the manner in which they can be used to describe light-particle interactions and their applications to nano-antennas. These methods can also serve as frameworks for fabricating simple models of quantum-emitters interacting with particles, allowing a better physical understanding of the underlying physics without being weighed down by the quasi-exact multipole formulations.