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# Engineering dipole-dipole couplings for enhanced cooperative light-matter interactions

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## Abstract

We present a novel design for a light-harvesting antenna that exhibits super-extensive scaling in its power output. By placement of a dielectric sphere within a molecular ring, we are able to engineer an effective Hamiltonian for the dipoles that generate "guide-sliding" states within the ring system that promote steady-state super-absorption in noisy room temperature environments. We perform direct comparison with previous designs for "guide-sliding" super absorbers and show that the new design outperforms these, as well as being significantly simpler to implement. Furthermore, we demonstrate the super-extensive scaling of the power output generated by a quantum thermal heat engine model and demonstrate that, utilising the setup developed, phonon relaxation does not impede the performance of these systems, but—in fact—enhances it.

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