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Superradiant nonlinear Thomson scattering. JORGE VIEIRA, MIGUEL PARDAL, J TITO MENDONCA, RICARDO FON-SECA, GoLP/Instituto de Plasmas e Fusao Nuclear, Instituto Superior Tecnico, Universidade de Lisboa, Lisbon, Portugal — Superradiance, a classical concept first introduced by Robert Dicke in 1954, is the anomalous radiance describing coherent photon emission from a collection of light-emitting particles. Initially proposed in the context of atomic physics, superradiance now provides valuable insights into the fields of quantum electrodynamics, quantum communications, astrophysics, being a crucial concept underlying lasing in free electron lasers. Superradiant regimes lead to peak radiation intensities that scale with the number of particles squared. This effect is intuitively expected when the distance between light-emitting particles is much smaller than the photon wavelength. This was the superradiance condition originally proposed in the seminal work by Dicke, and corresponds to the operation regime of free electron lasers. Here we predict a new superradiance effect that holds even in the limit of vanishing number of particles per radiation wavelength. We illustrate the concept in the form of a previously unrecognised superradiant Thomson scattering. This concept may open new superradiant emission regimes in plasma based accelerators, gyrotrons and free electron lasers.

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