

Назва	On synchronization of an ensemble of oscillators under superradiance conditions
Автори	Kuklin V.M, Poklonsky, E.V.
Теми:	modeling of physical processes
Дата публікації:	2025-12-08
Бібліографічний опис:	Kuklin V.M. Poklonsky E.V. (2025) On synchronization of an ensemble of oscillators under superradiance conditions/ East European Journal of Physics. – 2025. - EEJP. 4. - P. 172-182.
Короткий огляд (реферат):	<p>The problems of phase synchronization in an ensemble of oscillators or dipoles, and the mechanisms of coherent field generation in superradiance mode, are discussed. It is shown that an increase in the spread of the initial amplitudes of an ensemble of oscillators suppresses their phase synchronization and reduces the efficiency of field generation. The influence of noise is discussed; it is shown that, below the generation threshold, even an external initiating field cannot synchronize the phases of an ensemble of particles. When the generation threshold is exceeded, the initiating field may not be required. It is shown that the convergence of the oscillator phases with the field phases at the locations of moving oscillators is noticeable only near their exit from the system. At the same time, a complete coincidence of the phases of synchronized oscillators and the field phases in the region of their localization is not observed. Nevertheless, the intensity of the generation field in the superradiance mode significantly exceeds the spontaneous level, which allows us to speak about the signs of induced radiation. The features of the development of the quantum process of superradiance of an ensemble of dipoles are discussed, and a system of equations for its description is given. The features of the quantum analog of superradiance are qualitatively modeled, and the role of the Rabi frequency determining the dynamics of the population inversion is noted. The nutation of the population inversion in the region occupied by the field affect the field intensity not only in this local zone, but also in subsequent regions of the active zone. This explains the unusual nature of the generation development: the field growth in a certain region of the active zone first stabilizes and then decreases significantly. This decrease in intensity also occurs in the direction of radiation in the peripheral regions of the active zone, despite the large energy reserve in them in the form of unperturbed population inversion.</p>