Chirality selective enhanced correlation among quantum emitters by chiral metallic structures

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High-density of quantum emitters in population inversion state exhibit a cooperative emission (superfluorescence) through the correlated polarizations. Superfluorescence has three main characteristics [1]: the peak of the emission intensity proportional to the square of the number N of the quantum emitters, the pulse width of the emission proportional to $1/N$, and the coherence and the directivity in the emission.

We have studied the anomalous enhancement of the cooperative effect by metallic structures sustaining the localized surface plasmons so far, where we use our theoretical method that can analyze the emission time profile of arbitrarily configurated emitters in an arbitrary dielectric environment [2]. In that study, we have revealed the enhancement of cooperative effect in superfluorescence largely depends on the metallic structure and the emitters' arrangement.

In this contribution, we consider chiral spatial structures of the metal and particle arrangements (Fig. 1), and calculate the emission intensity of superfluorescence. The result (Fig. 2) shows that a definite chiral selectivity of the enhanced correlation in a superfluorescence. Furthermore, when examining the polarization state of the radiation, there was a chiral selective change. We can expect that these results will lead to a new methodology in chiral research. In this presentation, we will discuss the details conditions of the metal and emitters' configurations for the chiral selective behavior of the time evolution of the emission intensity, including the dependence of the metal size and the emitter resonance energy.

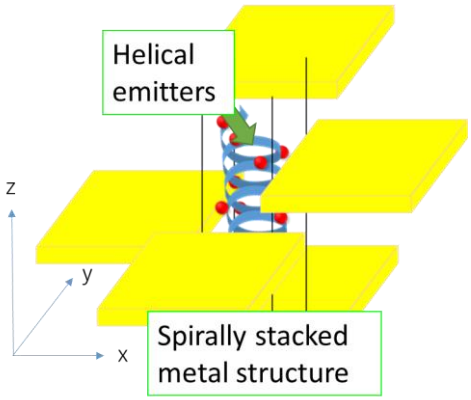

Fig. 1. Schematic diagram of metal and emitters' spatial structures with chirality.

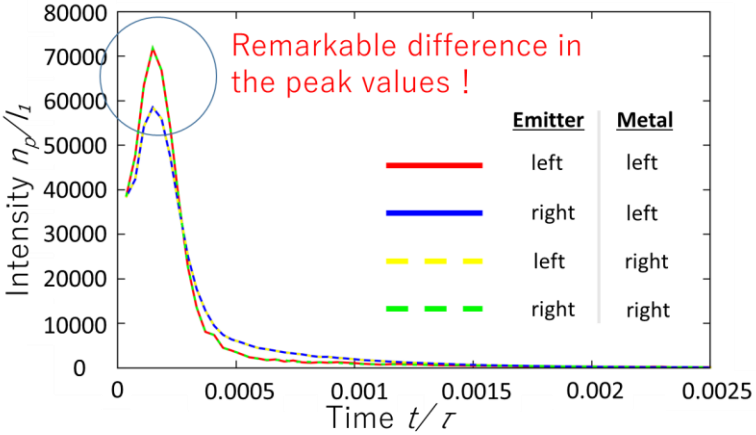

Fig. 2. The light emission intensity was calculated when the metal structures and the light emitters were arranged as shown in Fig. 1.

References

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