

令和 5 年 1 月 25 日

公益社団法人 応用物理学会  
北海道支部 会員各位

応用物理学会北海道支部講演会のお知らせ

下記講演会を開催いたしますので、多数ご参加下さいますようご案内申し上げます。

- 【演題】 A photonic quantum engine driven by superradiance  
【講師】 Prof. Kyungown An (Seoul National University, Korea)  
【日時】 2023 年 2 月 1 日 (水) 15:00-16:00  
【場所】 北海道大学 電子研会議室 (電子研棟玄関を入って左)  
【後援】 応用物理学会北海道支部

【講演要旨】

A superradiant state is a special quantum state of atoms capable of undergoing superradiance immediately without a time delay. We can prepare a superradiant state in an optical cavity by preparing  $N$  atoms in the same superposition state of the ground and excited states. These correlated atoms generate superradiance in the cavity even when the mean number of intracavity atoms is much less than unity [J. Kim et al., Science 359, 662 (2018)]. The superradiant state can be used to realize the long-sought superabsorption, the opposite of superradiance, by reversing the superradiance process in time through phase control [D. Yang et al., Nature Photonics 15, 272 (2021)]. By using the superradiant state, we can also realize a photonic quantum engine, where the atoms entering the cavity are our fuel and the photons are an engine medium exerting radiation pressure on the mirrors. Our engine operates between a thermal state and a superradiant state of reservoir at the same reservoir temperature. In our experiment, the effective engine temperature rose up to 150,000K because of the large ergotropy transfer from the reservoir through superradiance, resulting in the engine efficiency as high as 98% [J.-U. Kim et al., Nature Photonics 16, 707(2022)].

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