異分野基礎科学研究所

量子宇宙研究コアセミナー開催のお知らせ

“A photonic quantum engine driven by superradiance”

日　時：　2023年4月28日（金）10：00～11：30

会　場：　理学部本館１階 大会議室

講　師：　Prof. Kyungwon An　氏

Department of Physics and Astronomy, Seoul National University

【講演要旨】

A superradiant state is a special quantum state of atoms capable of producing superradiance immediately without a time delay. We can prepare a superradiant state in an optical cavity by exciting N atoms in the same superposition state of the ground and excited states. These phase-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 has been used to realize the long-sought superabsorption, the opposite of superradiance, by reversing the superradiance process in time [D. Yang et al., Nature Photonics 15, 272 (2021)]. Recently, we have realized 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 the reservoir at the same reservoir temperature. The effective engine temperature in the volume-expansion phase rose up to 150,000K because of the large ergotropy transfer from the reservoir through superradiance. The corresponding engine efficiency was as high as 98% [J.-U. Kim et al., Nature Photonics　16, 707 (2022)].

問い合わせ先：異分野基礎科学研究所　量子宇宙研究コア

笹尾　登（Email：sasao@okayama-u.ac.jp　内線 7768）