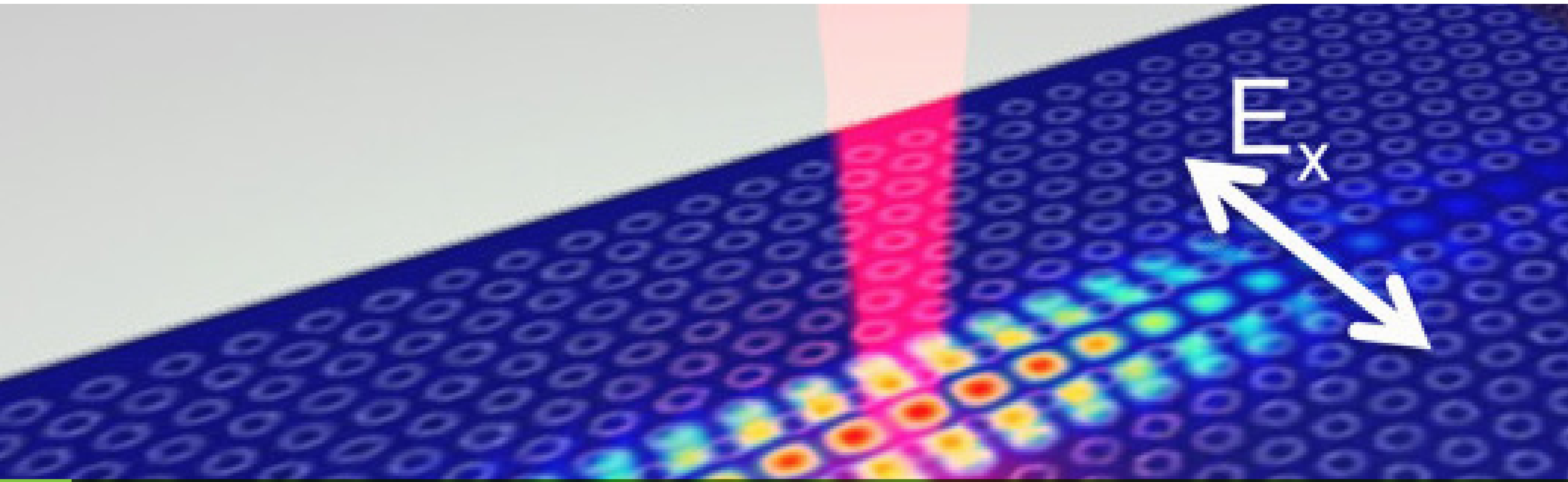
IMPACT STORY



2D MATERIALS INTEGRATE OPTICAL COMPONENTS FOR **IMPROVED PHOTONICS**

THE IMPETUS

Silicon has been identified as a major player in the photonics industry, but it is an inefficient emitter of light. In silicon photonics, multiple discrete optical components are integrated onto a single photonic chip, but in doing so the search for silicon-based light sources has evolved from a scientific quest to solving a technological bottleneck for scalable, complementary metal-oxide-semiconductor compatible light sources. Recently, emerging two-dimensional materials have opened the prospect of tailoring material properties based on atomic layers.

THE WORK

Few-layer phosphorene, which is isolated through exfoliation from black phosphorus (BP), is a great candidate to partner with silicon due to its layer-tunable direct band gap in the infrared where silicon is transparent. A team of researchers at the Center for Nanoscale Materials (CNM), a U.S. Department of Energy Office of Science user facility located at Argonne National Laboratory, and CNM users from Northwestern University, Universite Paris-Sud and Thales Research and Technology, used CNM capabilities to create a hybrid silicon optical emitter composed of few-layer phosphorene nanomaterial flakes coupled to a silicon photonic crystal resonator. The research demonstrates single-mode emission near the telecommunications band of 1550 nanometers under continuous wave optical excitation at room temperature. The solution-processed few-layer BP flakes enable emission across a broad range of wavelengths.

THE IMPACT

The research creates hundreds of hybrid silicon-based lasers in a single step, dramatically improving the prospects for silicon photonic devices.

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February 2020