Researchers demonstrate continuous lasing action in devices made from perovskite materials

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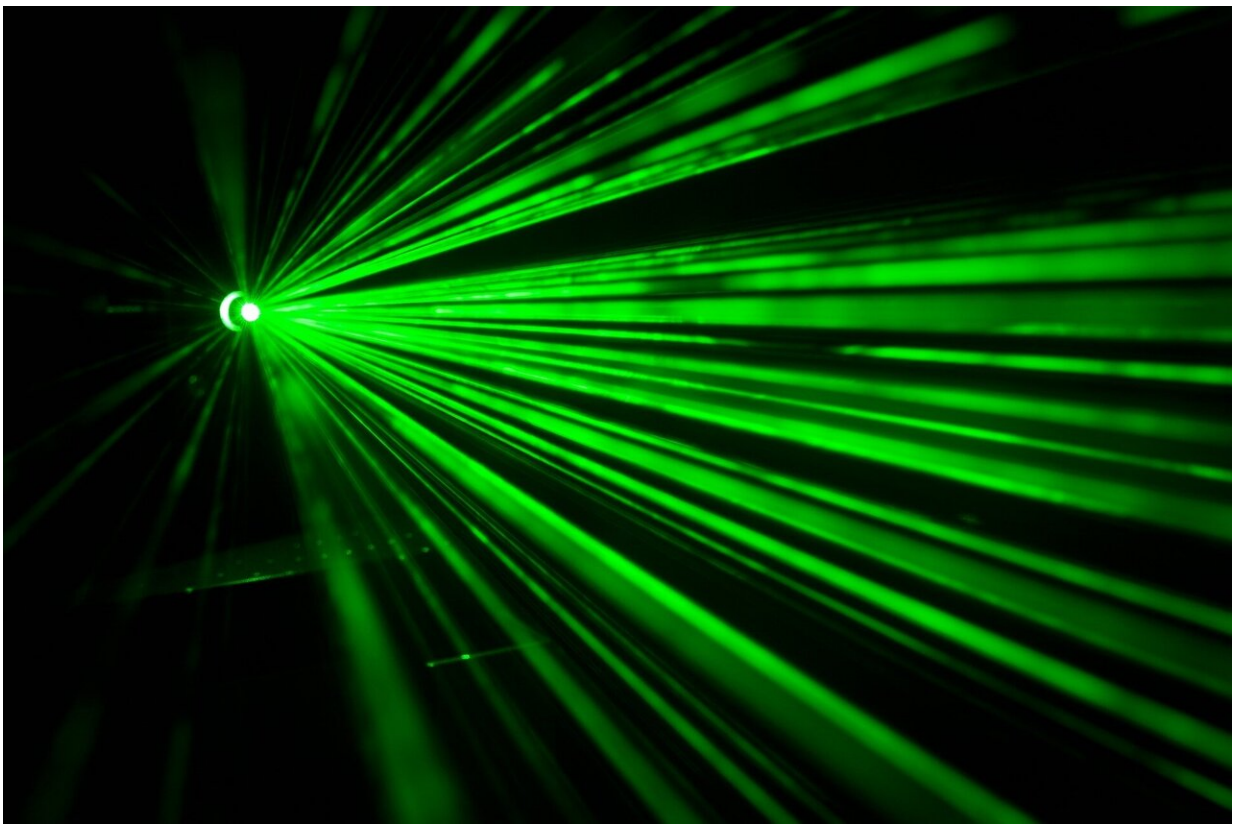

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Lead-halide perovskites are considered one of the most promising materials for the production of the lasers of the future. A new joint Tel

Aviv University (TAU) and Karlsruhe Institute of Technology (KIT) study published in *Nature Communications* on February 28 demonstrates remarkable continuous lasing action in devices made from perovskites.

"In contrast to previous studies around the world, this is the first study to exhibit continuous lasing action, as opposed to pulsed operation," says Prof. Jacob Scheuer of TAU's Department of Physical Electronics, who led the TAU team of researchers. "This family of materials is considered the most promising candidate for a future laser-based industry, because their fabrication is simple, fast and inexpensive compared to current semiconductor materials being used for these purposes.

"In addition, these materials can support the realization of solid-state lasers emitting in green, necessary for future lighting, displays and projectors," Prof. Scheuer adds. "Current semiconductor lasers emit light only in red and blue."

Devices that use continuous wave (CW) lasing can be powered directly from a regular power supply or a battery. Pulsed lasing requires additional electronics to generate the pulses and is often less efficient than CW operation.

For the research, Prof. Scheuer and his TAU colleagues produced devices using a novel technique called nano imprinting technology, an approach that applies moderate temperature and pressure to shape the material. At the same time, the KIT researchers designed the materials themselves and devised the optical characterization and measurement of the devices.

"This is an important breakthrough in the field of novel solid-state lasers because it demonstrates the potential of the perovskites material system for continuous lasing in the visible spectrum," Prof. Scheuer explains. "It proves that these materials 'have what it takes' to replace conventional

semiconductor laser technology, paving the way for laser-based illumination, projectors, cellphone and laptop displays, etc. These displays can provide brighter and more vivid colors that can operate even under direct sunlight without necessitating more power consumption.

"But for a practical system we need to improve the quality of the materials and structure so they can also work at room temperature and be powered by an electric power supply such as a regular battery," concludes Prof. Scheuer, noting that the research was carried out at low temperatures using light as an energy source for the devices. "These are our next challenges."

More information: Philipp Brenner et al. Continuous wave amplified spontaneous emission in phase-stable lead halide perovskites, *Nature Communications* (2019). DOI: 10.1038/s41467-019-08929-0

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