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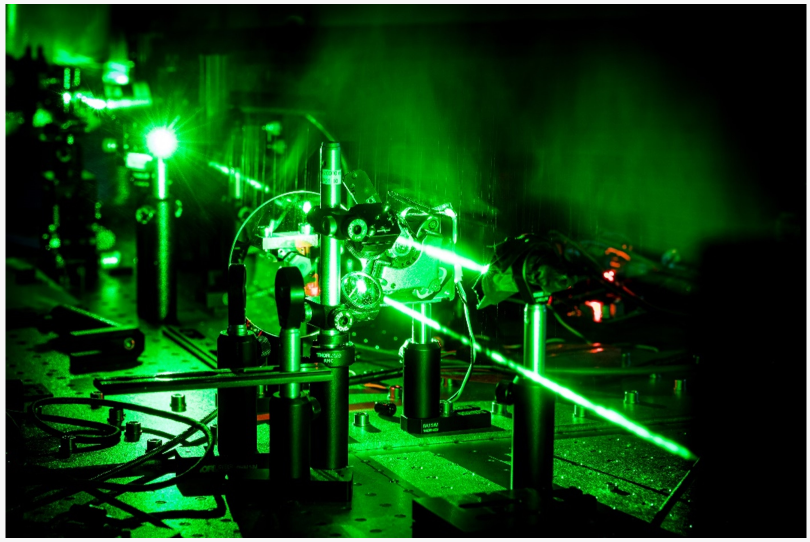
Researchers discover revolutionary and more eco-friendly approach to study light and matter interaction

The new method could revolutionize the development of emerging technologies.



This image captures a laser beam interacting with polariton microcavities, revealing how polaritons help protect emitting materials from brightness loss. Photo: Mikael Nyberg

TURKU, FINLAND, May 13, 2025 /EINPresswire.com/ -- Researchers at the University of Turku in Finland have developed a simple method to explore a complex area of quantum science. The discovery makes research in this field cheaper and more accessible, which could significantly impact the development of future laser, quantum and high-tech display technologies.

A team of researchers developed a new method for fabricating small structures known as optical microcavities. These structures allow scientists to study how light interacts with matter in a very precise process that can lead to the creation of novel quantum states called polaritons. Polaritons are unusual hybrid particles made from light and matter.

This innovative approach provides a low-cost, energy-efficient alternative to traditional vacuum-based fabrication, making quantum and photonics research more accessible.

Polariton microcavities are fundamental for understanding the interactions between light and matter. Moreover, they are crucial for emerging technologies, including ultra-efficient lasers, quantum optics, and next-generation screens. Until now, conventional fabrication has required expensive and energy-intensive vacuum deposition processes, such as sputtering and evaporation. This has limited the technology’s scalability and accessibility.

Now, the researchers have revolutionized the field by introducing a solution-processed method that utilizes a basic dip coating and spin coating technique to fabricate polariton microcavity without the need for expensive vacuum-based techniques.

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> *Associate Professor Konstantinos Daskalakis*

"Our approach makes it a lot easier to study strong light-matter interactions, because we offer a method that is simple, cheap, and far less energy-intensive than existing methods. We have eliminated the need for vacuum-based techniques without compromising performance, and that makes strong light-matter interaction studies more accessible to the researchers," says Associate Professor Konstantinos Daskalakis.

Beyond simplifying fabrication, the researchers managed to directly measure emitted light from polaritons. This provides significant insight into polariton dynamics.

This capability allowed the team to observe polaritons suppressing bimolecular annihilation in organic emitters—a key process that reduces light emission efficiency and contributes to long-term material degradation.

“Being able to measure light coming from polaritons made it possible for us to see how the presence of polaritons reduces emission bleaching. This is a critical step in understanding and improving the performance of polaritonic devices,” explains Doctoral Researcher Hassan Ali Qureshi.

With this innovative approach of combining accessibility, energy efficiency, and observing the polariton dynamics, the researchers have significantly expanded the potential of polariton microcavity research. This method also opens new possibilities for studying sensitive organic materials and developing more stable, efficient light-emitting technologies.

The results have been published in the journal Advanced Optical Materials.

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