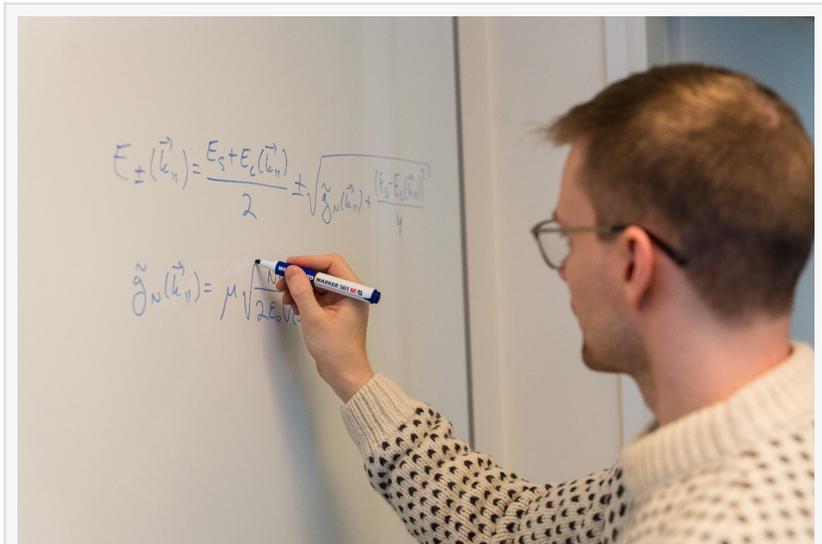


Next-generation OLEDs rely on finetuned microcavities

Researchers have developed a unified theory of microcavity OLEDs, guiding the design of more efficient and sustainable devices.

TURKU, FINLAND, February 19, 2026 /EINPresswire.com/ -- Researchers from the [University of Turku](#) in Finland have developed a unified theory of microcavity OLEDs, guiding the design of more efficient and sustainable devices. The work reveals a surprising trade-off: squeezing light too tightly inside OLEDs can actually reduce performance, and maximum efficiency is achieved through a delicate balance of material and cavity parameters.



The physics of microcavity OLEDs being unraveled by Olli Siltanen. Photo: Mikael Nyberg

Organic light-emitting diodes (OLEDs) offer several attractive advantages over traditional LED technology: they are lightweight, flexible, and more environmentally friendly to manufacture and recycle. However, heavy-metal-free OLEDs can be rather inefficient, with up to 75% of the injected electrical current converting into heat.

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Maximum efficiency in microcavity OLEDs is achieved through a delicate balance of material and cavity parameters”

*Associate Professor
Konstantinos Daskalakis*

OLED efficiency can be enhanced by placing the device inside an optical microcavity. Squeezing the electromagnetic field forces light to escape more rapidly instead of wasting energy as heat.

“It is basically like squeezing toothpaste out of a tube,”

explains Associate Professor Konstantinos Daskalakis from the University of Turku.

After a certain squeezing threshold, the original energy levels of the emitting material and the electromagnetic field hybridize. These mixed light-matter states are known as polaritons.

While the static energy levels of polariton OLEDs are well understood, much less is known about how the squeezing affects transitions between these states. As a result, the development of polariton OLEDs has largely relied on trial and error.

Now, a research group at the University of Turku has developed the first theoretical model that explains how these transition mechanisms change as the squeezing increases. Surprisingly, the model predicts that efficiencies decrease once polaritons are formed. This reduction arises from two distinct effects.

“Although polaritons emit light very quickly, they are shared states of typically hundreds of thousands of molecules, which dilutes the processes populating them,” explains Postdoctoral Researcher Olli Siltanen. “These population mechanisms can be further weakened if the polariton energies lie too far from the original molecular energy levels.”

According to the model, maximum efficiency in microcavity OLEDs is achieved through a delicate balance of material and cavity parameters. While the model finds polaritons with many molecules disadvantageous, all hope is not lost.

“Alternative device architectures allow us to reduce the number of molecules involved from hundreds of thousands to just a few,” says Daskalakis. “Such OLEDs have the potential to achieve record-breaking efficiencies.”

The results have been published in the journal [Materials Horizons](#).

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