New research opens avenues for more efficient and stable blue OLED displays

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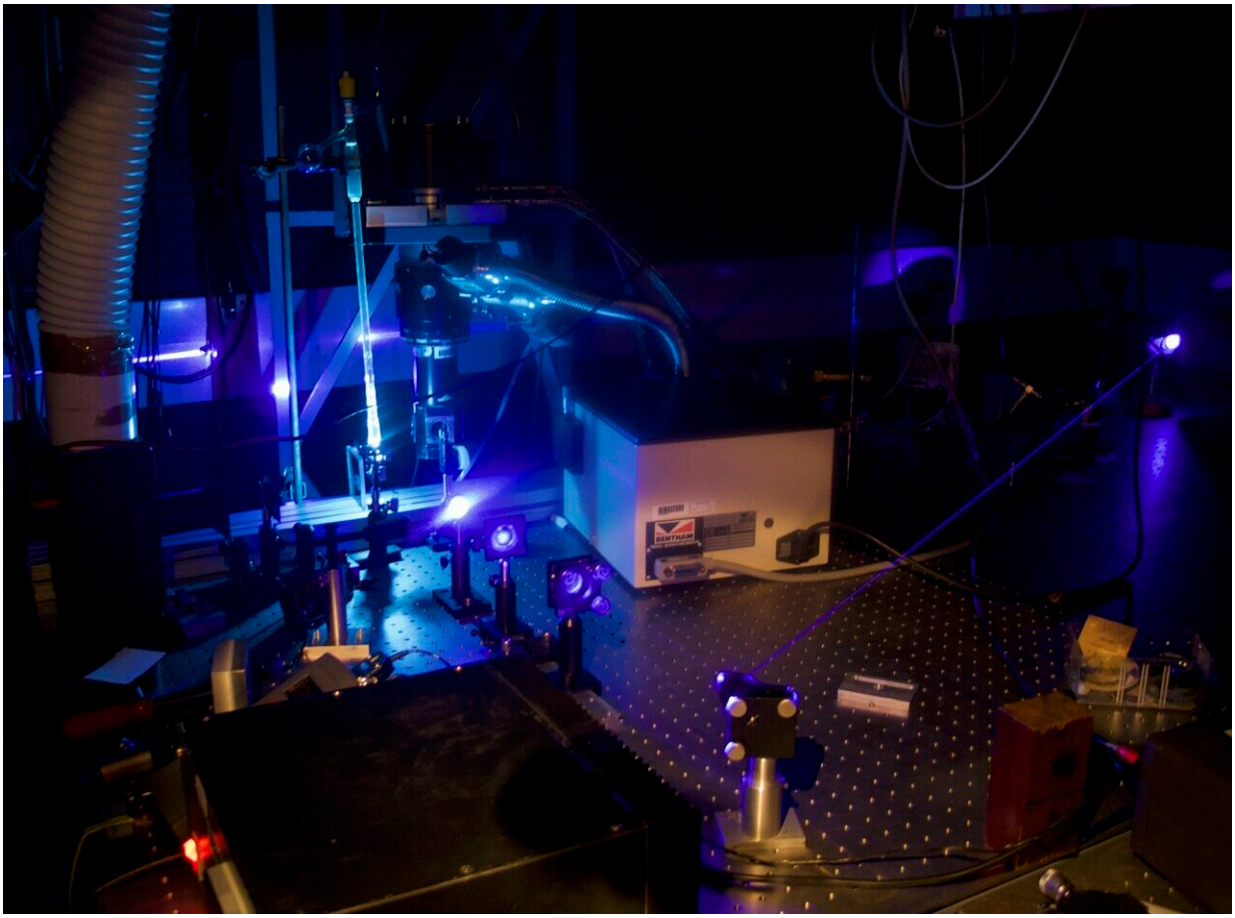


Credit: Durham University

New research from scientists at Durham University reveals an unexpected pathway toward brighter, more efficient, and more stable

blue organic light-emitting diodes (OLEDs).

The findings, published in the journal *Nature Photonics* could help enable the next generation of energy-saving display technologies.

OLED displays, used in most modern smartphones and TVs, rely on light emission from specialized organic molecules.

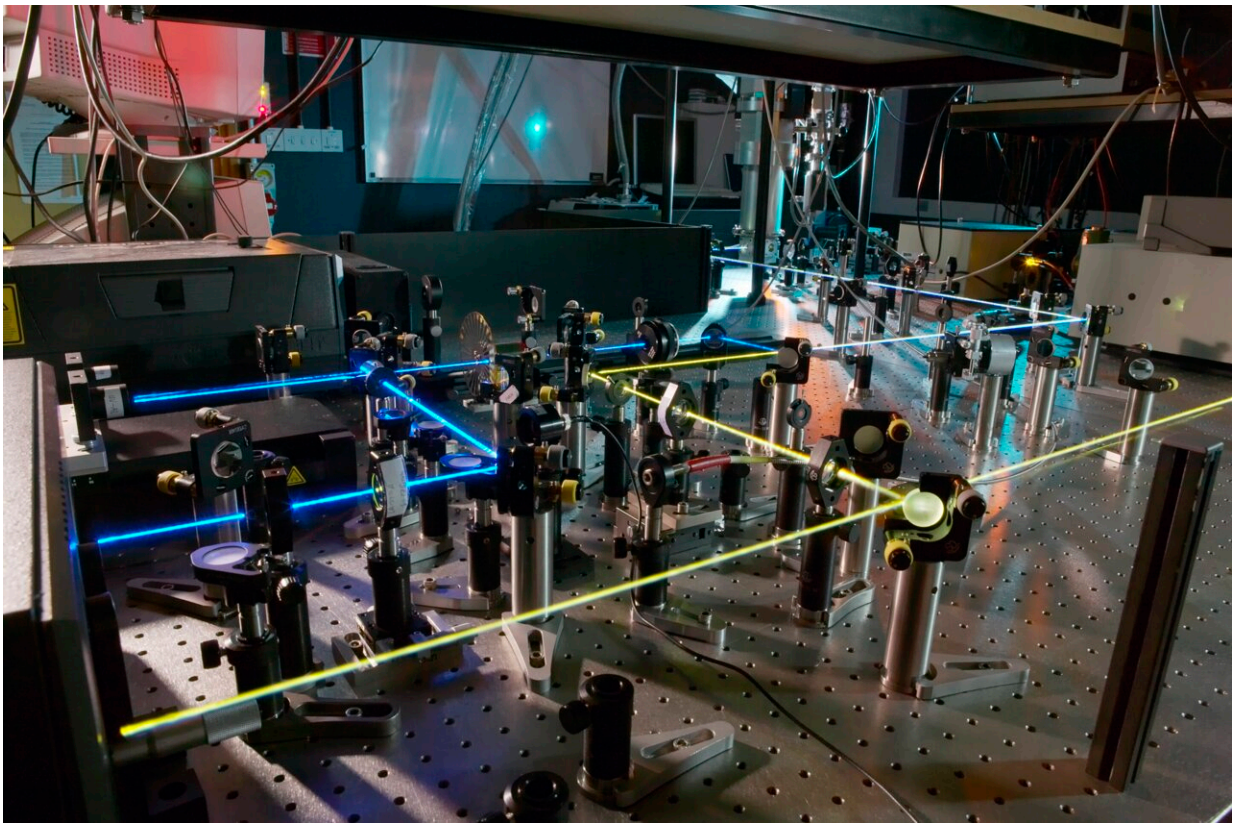
Obtaining stable, efficient blue emission suitable for displays remains a key challenge.

Now, Durham University researchers have unlocked a new design strategy using "hyperfluorescent" OLEDs, where energy is transferred from a "sensitizer" molecule to a separate "emitter" molecule.

Surprisingly, the team found that sensitizer molecules previously dismissed as poor emitters actually perform remarkably well in hyperfluorescent OLEDs.

"We discovered a 'blind spot' where materials overlooked by conventional thinking can become highly effective when used as sensitizers in hyperfluorescence OLEDs," said Kleitos Stavrou of Durham University, lead author of the study.

In particular, the molecule ACRSA was found to triple the OLED efficiency when used as a sensitizer in hyperfluorescence OLEDs.



Credit: Durham University

The researchers attribute this to ACRSA's rigid molecular structure and long-lived excited states.

Even more strikingly, using a greenish sensitizer, such as ACRSA, deep blue light emission can be achieved by transferring ACRSA's energy to a blue terminal emitter.

"This approach reduces exciton energy compared to direct blue emission in devices, allowing more stable, longer-lasting blue OLEDs," said senior author of the study, Professor Andrew Monkman of Durham University's Physics Department.

Overall, the strategy provides a new molecular design paradigm for stable and highly efficient displays.

"Our findings reveal an unexplored territory for hyperfluorescent OLEDs that could greatly expand material choices for the next generation of displays that will also use up to 30% less electricity," said Professor Monkman.

The researchers next plan to further develop hyperfluorescent OLEDs, with industrial partners, toward commercial applications.

More information: Key requirements for Ultra-Efficient Sensitisation in Hyperfluorescence OLEDs, *Nature Photonics* (2024). DOI: 10.1038/s41566-024-01395-1

Provided by Durham University