# Article information:

An electrically pumped surface-emitting semiconductor green laser | Science Advances  
<https://www.science.org/doi/10.1126/sciadv.aav7523>

# Article summary:

1. Researchers have developed the first all-epitaxial, distributed Bragg reflector-free electrically injected surface-emitting green laser using dislocation-free gallium nitride nanocrystal arrays.

2. The device operates at 523 nm and has a threshold current of 400 A/cm2, over one order of magnitude lower than previously reported blue laser diodes.

3. This development opens up possibilities for developing low-threshold surface-emitting laser diodes from the ultraviolet to the deep visible range, where device performance is no longer limited by the lack of high-quality DBRs, large lattice mismatch, and substrate availability.

# Article rating:

Appears moderately imbalanced: The article provides some useful information, but is missing several important points or pieces of evidence that would be required to present the discussed topics in a balanced and reliable way. You are encouraged to seek a more balanced perspective on the presented issues by exploring the provided research topics and looking at different information sources.

# Article analysis:

The article reports on the development of an all-epitaxial, distributed Bragg reflector (DBR)-free electrically injected surface-emitting green laser. The device operates at ~523 nm and exhibits a threshold current of ~400 A/cm2, which is over one order of magnitude lower compared to previously reported blue laser diodes. The authors propose and demonstrate a nanocrystal surface-emitting laser (NCSEL) diode, which is free of DBRs and can operate efficiently in the green spectrum. The NCSEL consists of InGaN/AlGaN nanocrystal arrays with precisely controlled size, spacing, and surface morphology.

The article provides a detailed explanation of the design and simulation process for the NCSEL diode, including energy band diagram and mode profile. The authors also discuss the challenges associated with developing GaN-based DBRs due to large lattice mismatch between GaN and AlN (~2.5%) and between GaN and InN (~11%), as well as difficulties in achieving efficient p-type conduction.

While the article presents a promising development in surface-emitting semiconductor lasers, it does not provide a comprehensive analysis of potential risks or limitations associated with this technology. Additionally, there is no discussion of potential environmental impacts or ethical considerations related to the production and use of these devices.

Overall, while the article provides valuable insights into the development of low-threshold surface-emitting laser diodes from the ultraviolet to the deep visible range, it would benefit from a more balanced presentation that considers potential drawbacks or limitations associated with this technology.

# Topics for further research:

* Environmental impact of semiconductor laser production
* Ethical considerations of surface-emitting laser diodes
* Limitations of GaN-based distributed Bragg reflectors
* Potential risks associated with nanocrystal surface-emitting lasers
* Efficiency of p-type conduction in GaN-based diodes
* Comparison of surface-emitting lasers to other semiconductor laser technologies

# Report location:

<https://www.fullpicture.app/item/96422cf44f99d204aff0af795b577a9c>