Self-consistent model of Individual quantum dot

-bent plane mesh version

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20 years ANNIVERSARY

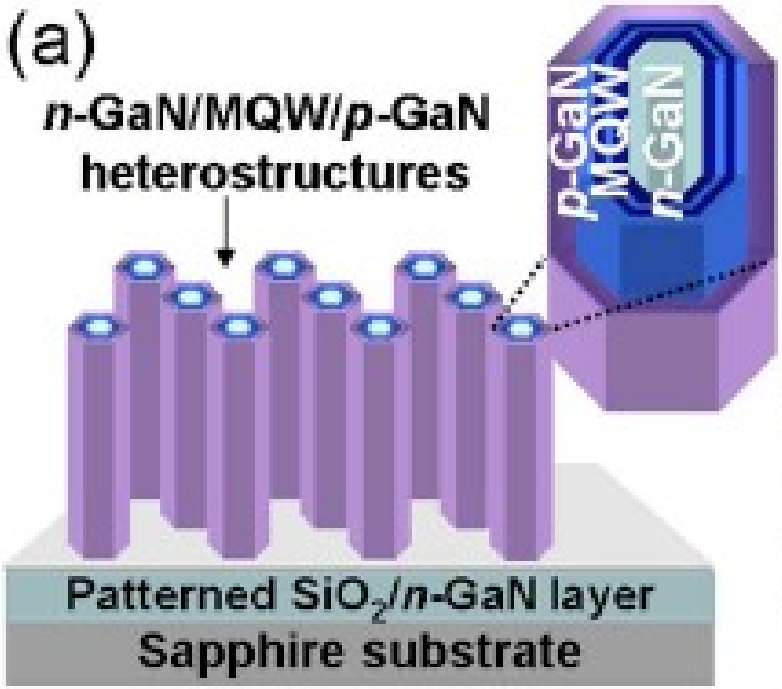
CROSSLIGHT

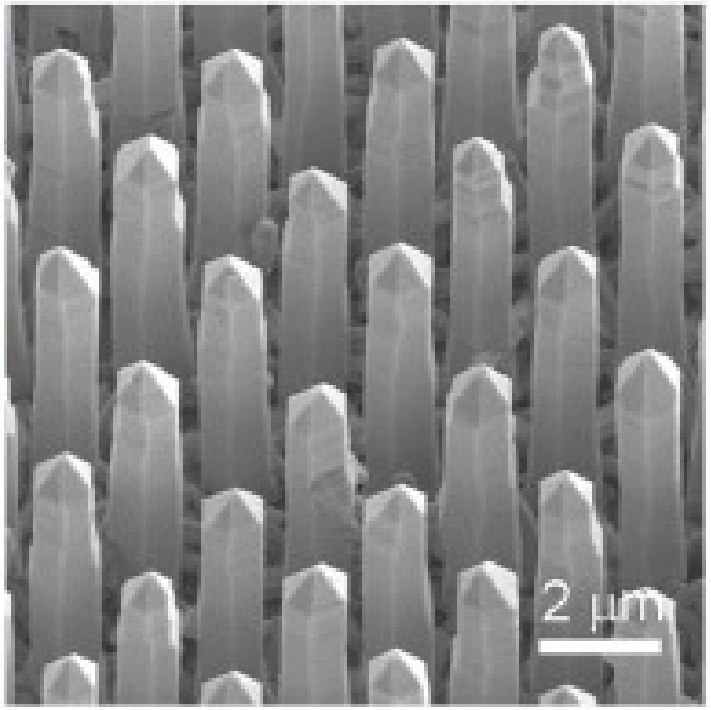
Reference structure:

APPLIED PHYSICS LETTERS
94, 213101 2009

GaN/ In1−*xGaxN/GaN/ZnO nanoarchitecture light emitting diode microarrays*

Chul-Ho Lee, Jinkyoung Yoo, Young Joon Hong, Jeonghui Cho, Yong-Jin Kim, Seong-Ran Jeon, Jong Hyeob Baek, and Gyu-Chul Yi





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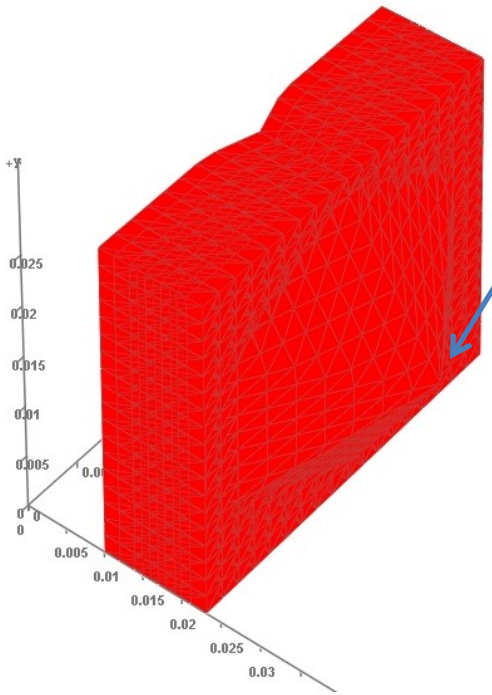
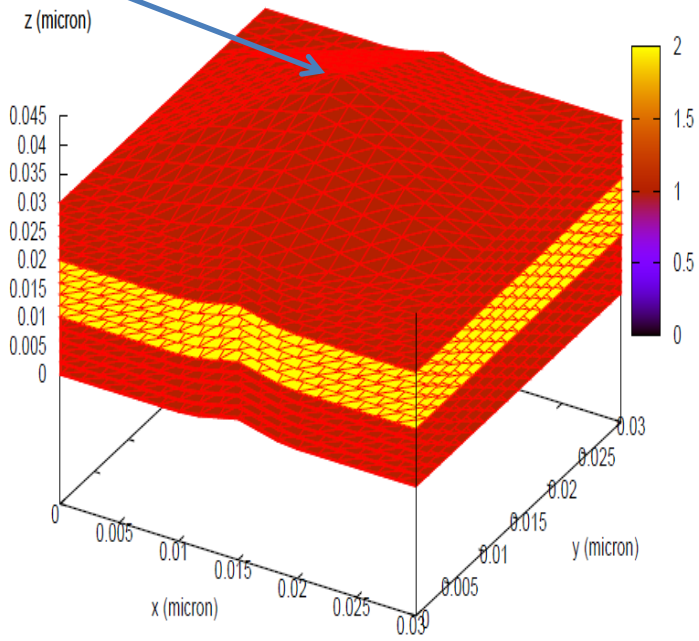
Tip states in nanowire



Tip of nanowire forms unique quantum dot worth special modeling



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Individual quantum dot model

- Arbitrary FEM mesh structure. Based on CSUPREM process simulation or from bent-plane feature of APSYS.
- Direct solution of k.p based model to find the quantum states.
- Optical or electrical pumping calculation treated self-consistently.
- Non-planar polarization charge model within QD.
- Optical transition between quantum states to predict EL and optical gain spectrum.

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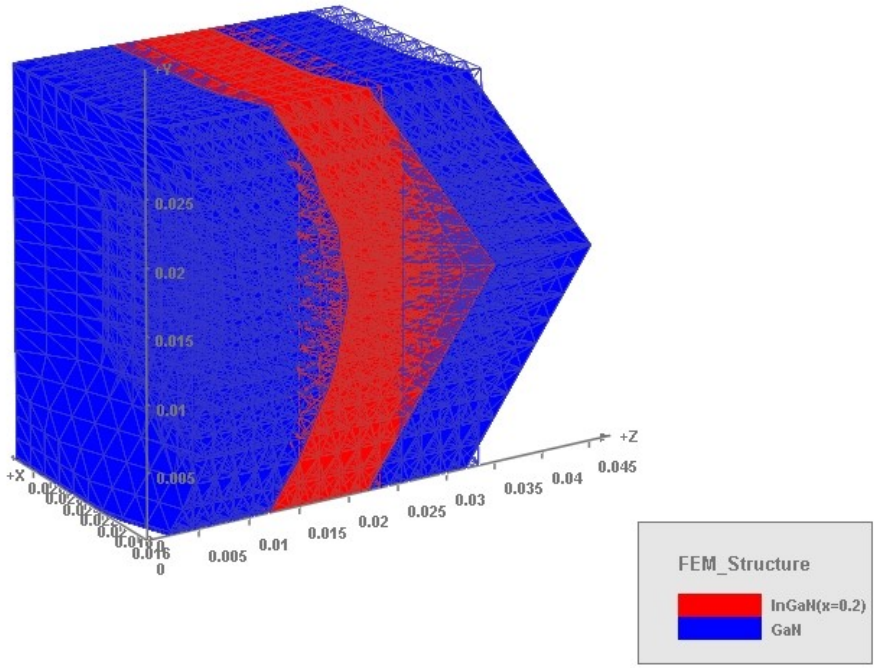
FEM Structure (half-cut)



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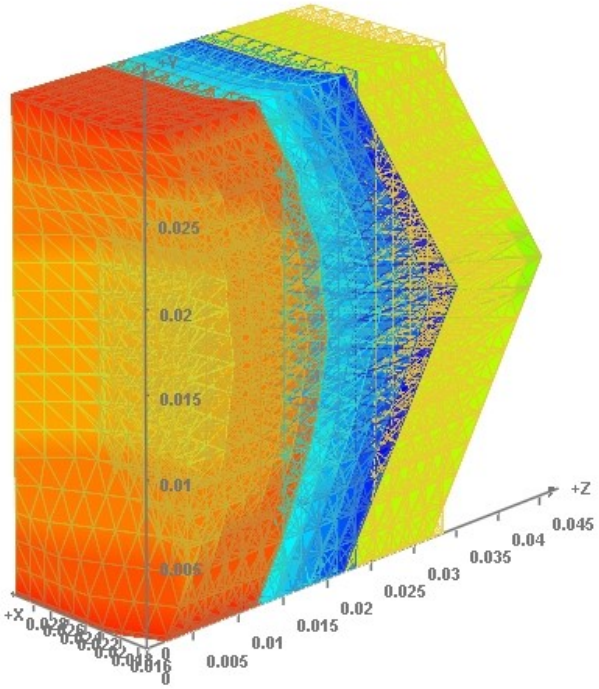
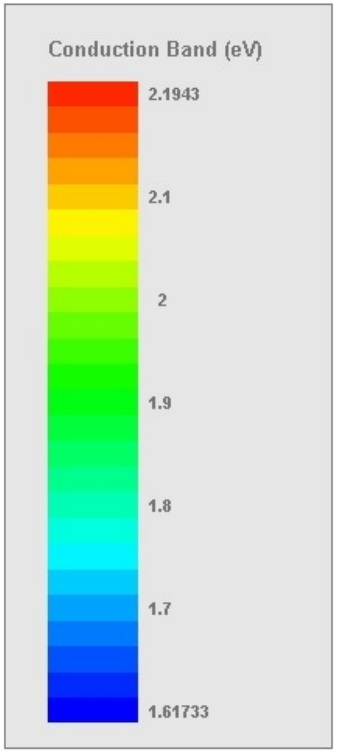
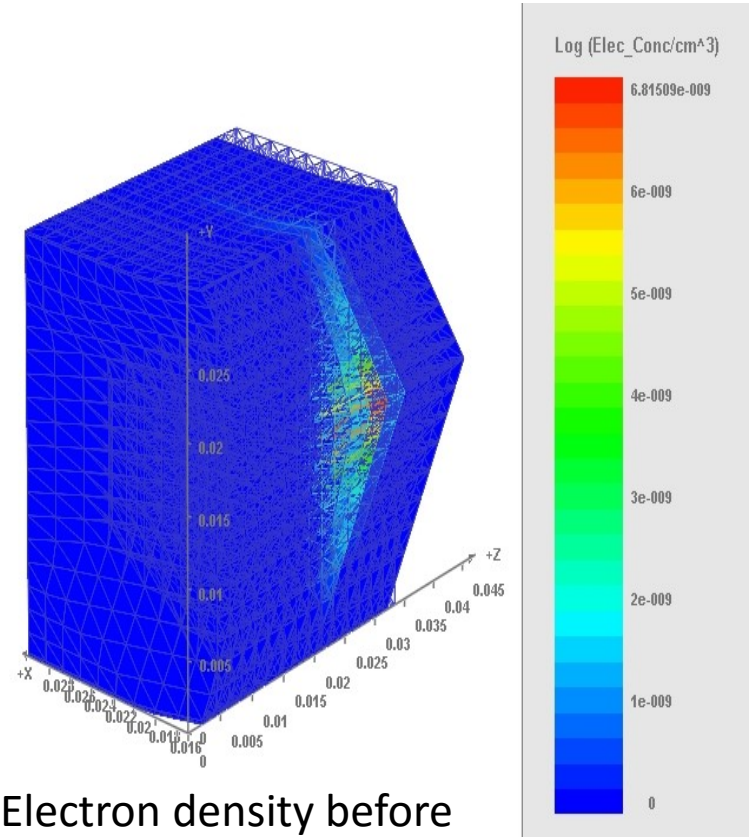
Conduction band profile

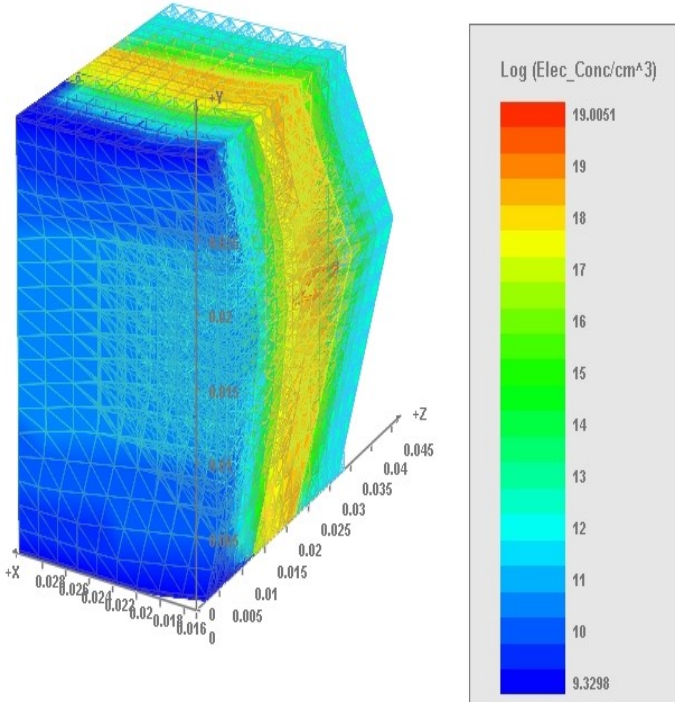




Electron density



Electron density before pumping



Electron density after pumping

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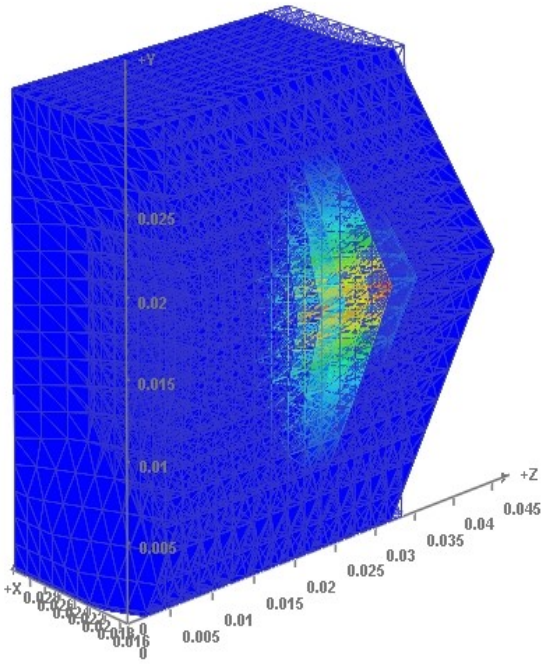
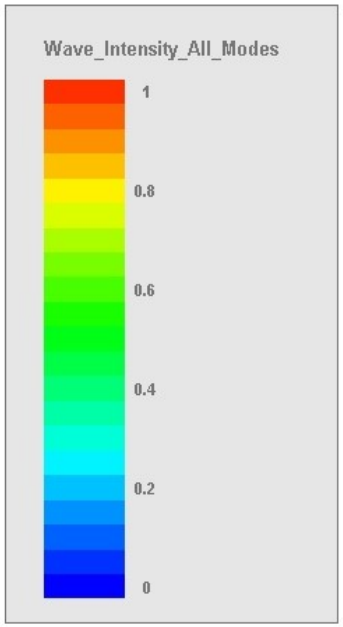
Confined QD quantum states





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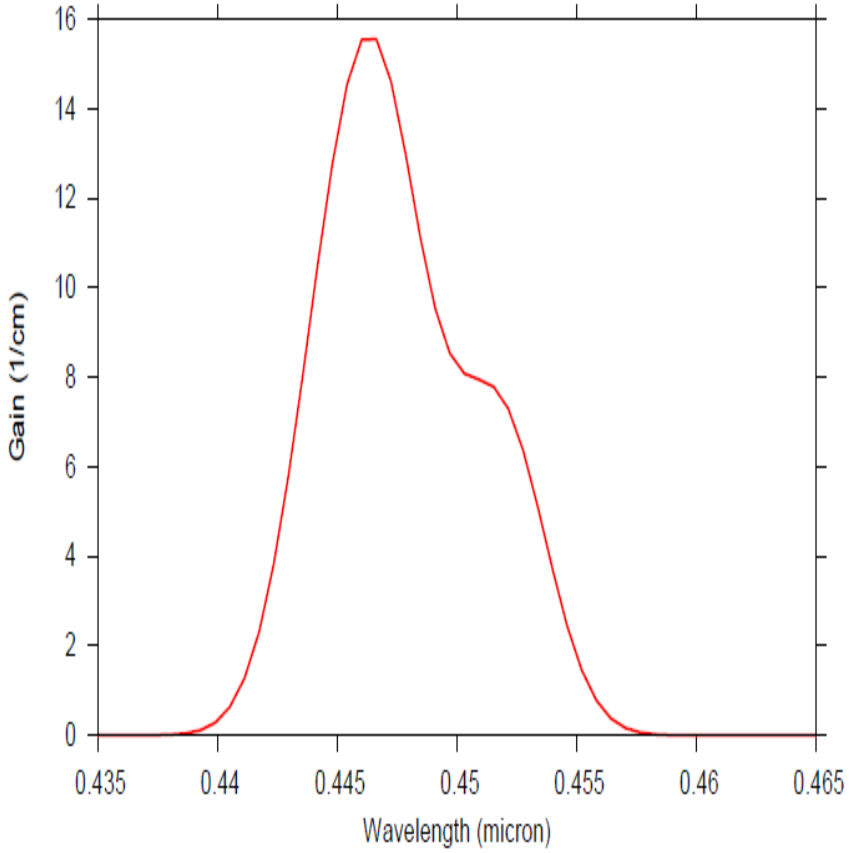
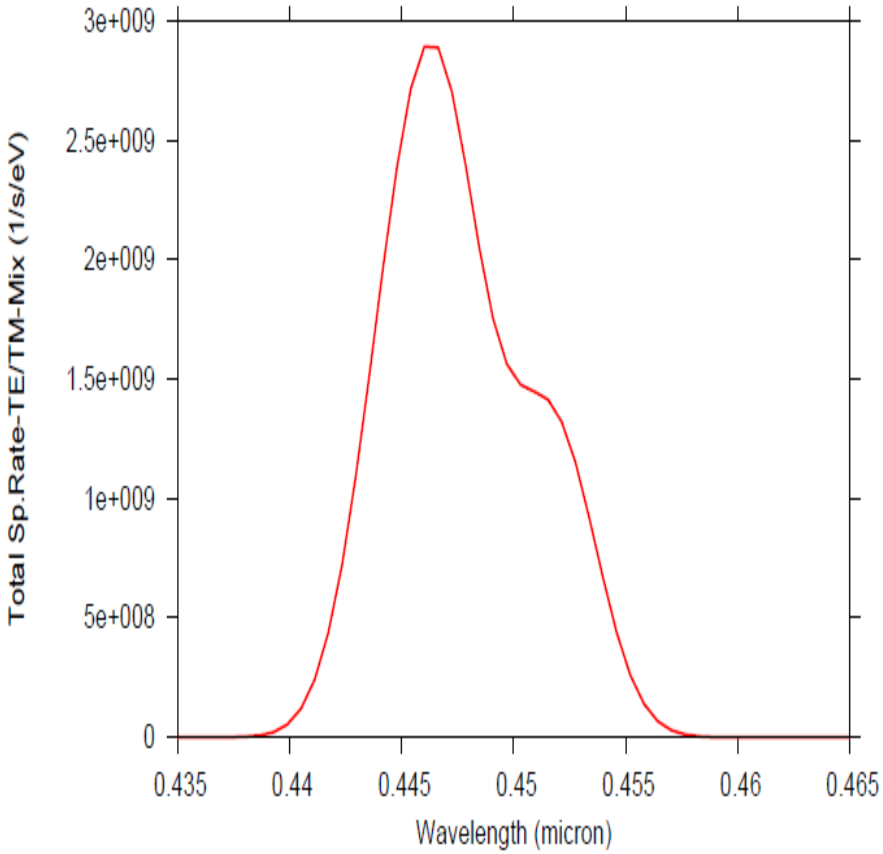
Optical gain and EL





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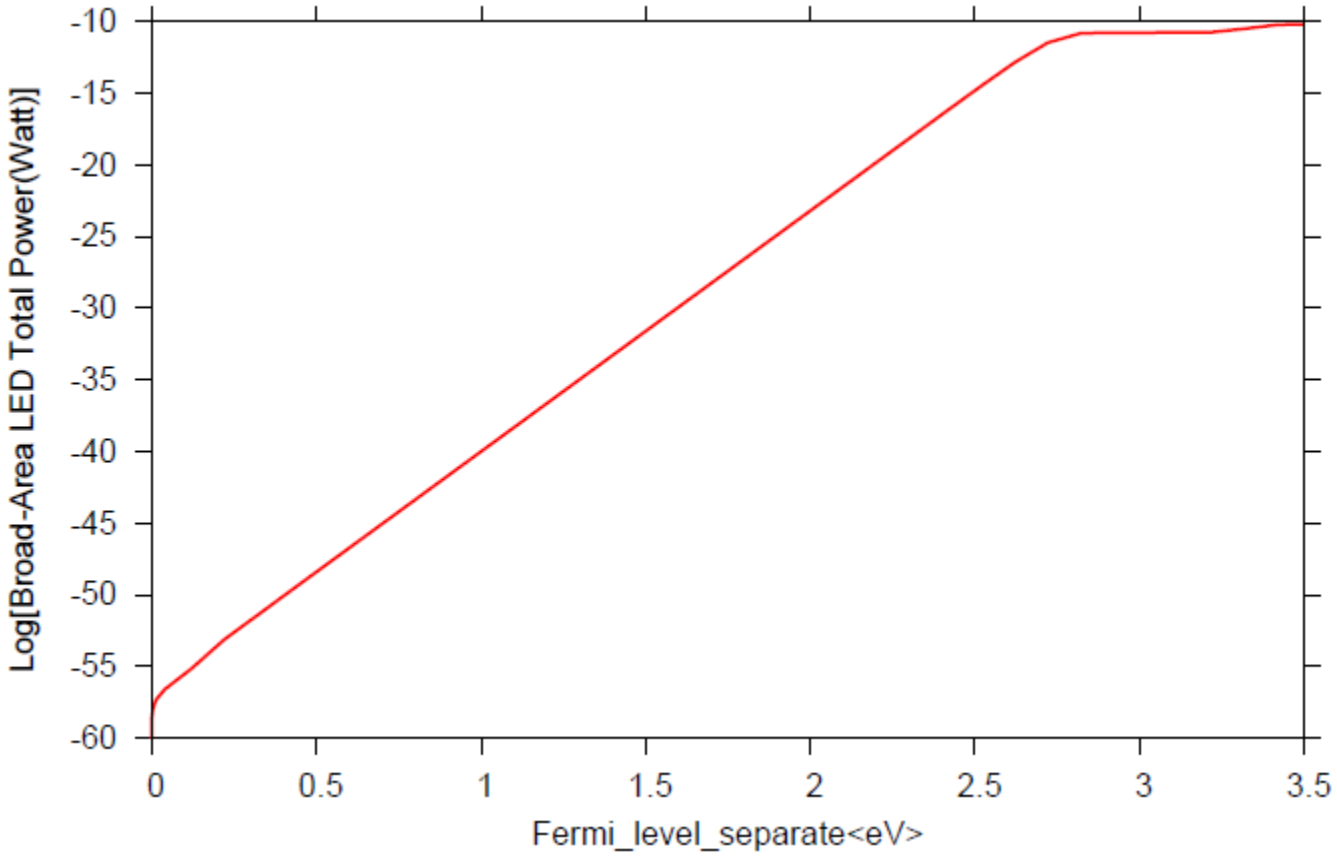
Single QD emission power



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Summary

- A self-consistent model taking into account effects of polarization charges, strain and stress to band structure.
- EL emission spectrum and pumping characteristics as output.
- Distribution of stress to be computed next.

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