J. Clarence Karcher Lecture

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We Are Pleased to Announce a Seminar
Presented By

Victor Klimov
Los Alamos National Laboratory

Friday, November 4, 2022
4:15 pm
National Weather Center
Room 1313

Realization of Colloidal Quantum Dot Laser Diodes:
A New Beginning after a 20-Year-Long Journey

Colloidal quantum dots (QDs) are attractive materials for realizing solution processable laser diodes that could benefit from the unique features of these zero-dimensional structures such as size-controlled emission wavelengths, low optical-gain thresholds, and ease of integration with photonic and electronic circuits.[1] However, the implementation of such devices has been hampered by fast Auger recombination of gain-active multicarrier states, poor stability of QD films at high current densities, and the difficulties in obtaining net optical gain in a complex device stack wherein a thin electroluminescent QD layer is combined with optically lossy charge-transport layers.[2] Recently, we have resolved these challenges and achieved laser action in electrically pumped devices that employ continuously graded QDs with strongly suppressed Auger recombination. These dots are integrated with a low-loss photonic waveguide incorporated into a pulsed, high-current density light-emitting diode. The developed prototype colloidal QD laser diodes exhibit strong, broad-band optical gain and demonstrate low-threshold, room-temperature laser action at the band-edge and higher-energy excited-state transitions.

1 Park, Y.-S., Roh, J., Diroll, B. T., Schaller, R. D. & Klimov, V. I. Colloidal quantum dot lasers. *Nat. Rev. Mater.* **6**, 382-401 (2021).
2 Jung, H., Ahn, N. & Klimov, V. I. Prospects and challenges of colloidal quantum dot

Refreshments will be served at 4:00 pm

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