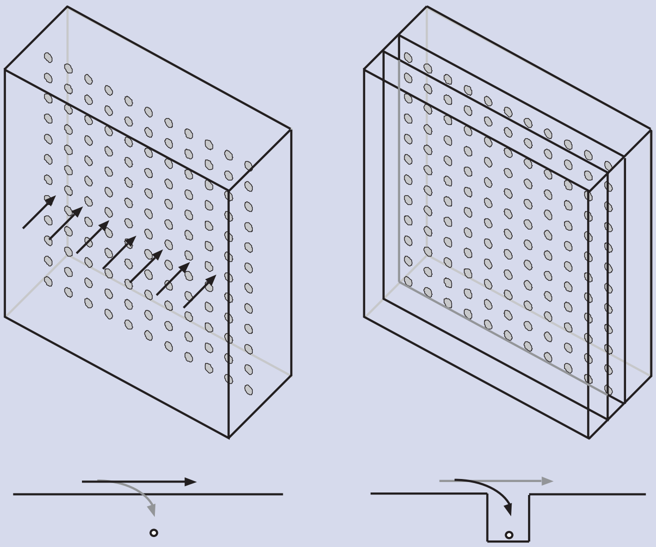

HOW DOTS-IN-A-WELL (DWELL) LASERS WORK:

Previous semiconductor quantum dot lasers used the configuration on the left. Because the indium arsenide dots only occupy about 4% of the area, current collection by the dots is inefficient. The energy diagram underneath shows that most carriers bypass the dots. DWELL lasers are depicted on the right. Introducing a low energy indium gallium arsenide well layer around the dots has two important effects. The first is to provide a reservoir of indium for the dots, ensuring the proper wavelength for infrared countermeasures or eyesafe laser radar. The second effect is to capture and direct the carriers toward the dots. As shown in the bottom diagram on the right, the well acts to funnel carriers toward the dots, significantly increasing the current collection by the dots, and subsequent power output.

However, when the DWELL lasers were tested at AFRL, the linewidth enhancement factor was 0.1, a significant improvement and another indication of the atomic-like properties of semiconductor quantum dots. This reflects the payoff expected from the quantum dot's sharper transitions, compared to quantum well lasers without embedded quantum dots. Further improvements are expected from improving the size uniformity of the quantum dots.

Using the insights already gained from studying InAs/GaAs quantum dots, Dr. Ron Kaspi of AFRL is leading an effort at the UNM FAST Center to extend these results to quantum dots in the semiconductor gallium antimonide (GaSb). Dr. Kaspi previously has made extensive progress in more conventional GaSb lasers using advanced growth techniques coupled with direct monitoring of the growth process. This has lead to the FAST Center/AFRL team demonstrating GaSb semiconductor lasers in the IR at two micrometers and four micrometers, and to providing these lasers to Air Force and DoD contractors for incorporation into working IR countermeasure systems. The increased spectral purity and power output will allow longer range defense against IR guided missiles. Initial results on extending quantum dots to the GaSb system are encouraging.

Maj. Dan Johnstone
Program Manager, AFOSR/NE
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Dr. Michael R. Berman Honored With Arthur S. Flemming Award

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Dr. Michael Berman

Dynamics and Theoretical Chemistry Programs and basic research team, was selected for his outstanding contributions in the executive/administrative category. Dr. Berman is a winner of several other awards and was previously selected as an AFOSR Senior Fellow in 1995.

Dr. Berman won the Flemming Award for his meritorious and effective leadership in managing multidisciplinary Air Force laboratory, university and industry research partnerships. His management of projects and research teams has advanced the understanding of basic mechanisms involved in chemical reaction dynamics and energy transfer. Many of his projects have rapidly addressed Air Force operational issues in the areas of rocket propellants, aircraft and spacecraft signatures and surveillance, chemical lasers and new materials.

He has guided both Air Force and university laboratory researchers in developing and applying predictive tools to design new materials and improve materials processing and chemical synthesis. He coordinated an interagency atmospheric chemistry program — NASA, the National Science Foundation and the AFRL's KAFB site laboratory — that significantly supported the mission of Air Force Space Command. As the AFOSR technology coordinator for High Energy Density Materials, he assembled a Laboratory/university team that has earned the Air Force an international reputation as a scientific leader in providing affordable, safe access to space.

He nurtures research teams, serves as mentor and inspires a commitment to scientific excellence. Four of his six Air Force laboratory programs have earned recognition as AFOSR Star Teams for performing world-class research. He also serves as the Air Force representative for the Chemistry Scientific Planning Group for DoD's Science and Technology Reliance Basic Research Panel. He frequently participates in government review panels and advisory boards, and has served as session chair at national and international meetings.

Dr. Berman has more than two decades of experience in scientific research and management in academia, industry and government. He is the author of 35 published scientific papers and is a member of the American Chemical Society, American Physical Society and Sigma Xi.

Dr. Berman is the Program Manager at AFOSR/NL. He can be reached at (703) 696-7781.