



**Laser Diode Bar**

# Diode Laser Arrays

**Jens W. Tomm, Juan Jiménez**



## **Diode Laser Arrays:**

Monolithic Diode-Laser Arrays Nils W. Carlson, 2012-12-06 Over the last two decades the search for a compact high power semiconductor source has produced many designs and concepts for monolithic diode laser arrays and optical amplifiers However only a few design approaches have emerged with the potential for producing high power high brightness monolithic sources Although semiconductor diode lasers are the most compact highest gain and most efficient laser sources challenges remain in developing structures that will produce high quality diffraction limited output beams This book presents and analyzes the results of work performed over the last twenty years in the development of high brightness diode laser arrays

**Diode Laser Arrays** Dan Botez, Don R. Scifres, 1994-07-28 This book provides a thorough overview of the principles and uses of semiconductor diode laser arrays Coherent incoherent edge and surface emitting horizontal and vertical cavity individually addressed lattice matched and strained layer arrays are all discussed in detail

*2.3 Micron High Power Continuous Wave Diode Laser Arrays*, 2004 Report developed under STTR contract for topic AFO3TO25 2 3 Micron High Power Continuous Wave Diode Laser Arrays This final technical report describes progress made to demonstrate the technical feasibility of high power GaSb based semiconductor laser arrays These arrays have many potential applications including infrared countermeasures IRCM pumping of solid state lasers low probability of intercept communication links and trace gas analysis Civilian applications exist in the fields of medical diagnostics and dermatological treatments The research involved the fabrication and complete characterization of single emitter GaSb based devices Successful results with the single emitter devices led to the demonstration for the first time of a one dimensional 2 3 micr9n laser array The array produced 10 watts in continuous wave operation 18 5W in long pulse operation and over 20W in short pulse operation short pulse power limited by current source

**Non-parallel Etched Facet Diode Laser Arrays** Daniel Alphonse Francis, 1997

**High-Power Diode Laser Arrays for Large Scientific Lasers and Inertial Fusion**, 2014 *Diode-Pumped Micro-Laser Arrays* R. Waarts, SPECTRA DIODE LABS INC SAN JOSE CA., 1994 In this work SDL investigated the operation of 2 D high power micro laser arrays based on novel monolithic surface emitting laser diode arrays coupled to Yb YAG and Er YSGG micro laser crystals The experimental demonstrations include 1 200 mW q cw single Yb YAG microlaser 2 930 mW cw linear 12 element Er YSGG micro laser 3 130 Watt q cw 2 D surface emitting laser diode array at 970 nm and 4 600 mW q cw from an 18 element 3 D Er YSGG microlaser array The experiments performed at SDL under this contract demonstrate the suitability of monolithic 2 D laser diode arrays for pumping solids state lasers In addition the experiments show the flexibility of the micro laser concept Using different pump wavelengths in combination with different micro lasers a wide output wavelength range from 1 micron to 3 micron is demonstrated Finally the micro laser array is shown to be scalable by exploiting one and two dimensional laser diode pump arrays

Performance Improvements in Diode Laser Arrays, 1994 The average power performance capability of semiconductor laser diode arrays has improved dramatically over the past several

years Additionally optical conditioning technologies have been developed that increase the effective radiance of stacked two dimensional arrays by nearly two orders of magnitude These performance improvements have been accompanied by cost reductions that now make feasible the replacement of flashlamp pump sources by laser diode arrays in a large variety of military and commercial solid state laser systems Applications of Microlens-conditioned Laser Diode Arrays ,1995 The ability to condition the radiance of laser diodes using shaped fiber cylindrical microlens technology has dramatically increased the number of applications that can be practically engaged by diode laser arrays Lawrence Livermore National Laboratory LLNL has actively pursued optical efficiency and engineering improvements in this technology in an effort to supply large radiance conditioned laser diode array sources for its own internal programs This effort has centered on the development of a modular integrated laser diode packaging technology with the goal of enabling the simple and flexible construction of high average power high density two dimensional arrays with integrated cylindrical microlenses Within LLNL the principal applications of microlens conditioned laser diode arrays are as high intensity pump sources for diode pumped solid state lasers DPSSLs A simple end pumping architecture has been developed and demonstrated that allows the radiation from microlens conditioned two dimensional diode array apertures to be efficiently delivered to the end of rod lasers To date pump powers as high as 2.5 kW have been delivered to 3 mm diameter laser rods Such high power levels are critical for pumping solid state lasers in which the terminal laser level is a Stark level lying in the ground state manifold Previously such systems have often required operation of the solid state gain medium at low temperature to freeze out the terminal laser Stark level population The authors recently developed high intensity pump sources overcome this difficulty by effectively pumping to much higher inversion levels allowing efficient operation at or near room temperature Because the end pumping technology is scalable in absolute power the number of rare earth ions and transitions that can be effectively accessed for use in practical DPSSL systems has grown tremendously **Surface Emitting Semiconductor Lasers and Arrays** Gary A. Evans, J. M. Hammer, 1993 Reviews all the basic types of surface emitting semiconductor lasers including vertical cavity etched mirror integrated beam deflectors and grating out coupled devices The book also addresses such topics as edge emitting arrays thermal management and coherence Diode Pumped Solid State (DPSS) Lasers Mark W. Dowley, 1998 Tailoring the Emission of Stripe-array Diode Lasers with External Cavities to Enable Nonlinear Frequency Conversion Andreas Jechow, 2009 A huge number of applications require coherent radiation in the visible spectral range Since diode lasers are very compact and efficient light sources there exists a great interest to cover these applications with diode laser emission Despite modern band gap engineering not all wavelengths can be accessed with diode laser radiation Especially in the visible spectral range between 480 nm and 630 nm no emission from diode lasers is available yet Nonlinear frequency conversion of near infrared radiation is a common way to generate coherent emission in the visible spectral range However radiation with extraordinary spatial temporal and spectral quality is required to pump frequency conversion Broad area BA

diode lasers are reliable high power light sources in the near infrared spectral range They belong to the most efficient coherent light sources with electro optical efficiencies of more than 70% Standard BA lasers are not suitable as pump lasers for frequency conversion because of their poor beam quality and spectral properties For this purpose tapered lasers and diode lasers with Bragg gratings are utilized However these new diode laser structures demand for additional manufacturing and assembling steps that makes their processing challenging and expensive An alternative to BA diode lasers is the stripe array architecture The emitting area of a stripe array diode laser is comparable to a BA device and the manufacturing of these arrays requires only one additional process step Such a stripe array consists of several narrow striped emitters realized with close proximity Due to the overlap of the fields of neighboring emitters or the presence of leaky waves a strong coupling between the emitters exists As a consequence the emission of such an array is characterized by a so called supermode However for the free running stripe array mode competition between several supermodes occurs because of the lack of wavelength stabilization This leads to power fluctuations spectral instabilities and poor beam quality Thus it was necessary to study the emission properties of those stripe arrays to find new concepts to realize an external synchronization of the emitters The aim was to achieve stable longitudinal and transversal single mode operation with high output powers giving a brightness sufficient for efficient nonlinear frequency conversion For this purpose a comprehensive analysis of the stripe array devices was done here The physical effects that are the origin of the emission characteristics were investigated theoretically and experimentally In this context numerical models could be verified and extended A good agreement between simulation and experiment was observed One way to stabilize a specific supermode of an array is to operate it in an external cavity Based on mathematical simulations and experimental work it was possible to design novel external cavities to select a specific supermode and stabilize all emitters of the array at the same wavelength This resulted in stable emission with 1 W output power a narrow bandwidth in the range of 2 MHz and a very good beam quality with M

*Studies of Phase-locked Semiconductor Laser Arrays* Yihjye Twu,1985 *Near-diffraction-limited High-power Pulsed and CW Antiguided Semiconductor Laser Arrays* Haiquan Yang,1999 *Quantum-Well Laser Array Packaging* Jens W. Tomm,Juan Jiménez,2006-12-01 Publisher s Note Products purchased from Third Party sellers are not guaranteed by the publisher for quality authenticity or access to any online entitlements included with the product The very latest nanoscale packaging techniques needed to keep quantum well lasers functioning In this book the authors address the nanoscale packaging issue by providing you with state of the art screening and packaging techniques not found in any other resource

**Single-element Optical Injection Locking of Diode-laser Arrays** ,1986 By optically injecting a single end element of a semiconductor laser array both the spatial and spectral emission characteristics of the entire laser array is controlled With the output of the array locked the farfield emission angle of the array is continuously scanned over several degrees by varying the injection frequency

**Diode Laser Satellite Systems for Beamed Power Transmission** Michael David

Williams,1990     **High Power Laser Diodes and Applications** Luis Figueroa,1988     Quantum-Well Laser Array Packaging Jens W. Tomm,Juan Jiménez,2007 Quantum well lasers offer the promise of lightning fast data communications 10 to 100 times faster than broadband While the architecture for these devices already exists they suffer from material packaging problems This book addresses this critical issue It offers screening and packaging techniques useful for researchers     *Laser Diode Technology and Applications* ,1989     Development of Lasers Optimized for Pumping Ti:Al<sub>2</sub>O<sub>3</sub> Lasers Glen A. Rines,1994

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