

Thermal Limits on Solid State Laser Scaling

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This paper examines the tradeoffs which govern the relation between high power and good beam quality in solid state and fiber lasers.

In recent years, the average power levels produced by diode-pumped solid state and fiber lasers have been increased dramatically, allowing multikilowatt operation for a variety of applications. A principal difference between solid state and fiber lasers, on the one hand, and gas lasers is the rate at which waste heat can be removed from the gain medium. Whereas convective heat transfer and the physical removal and replacement of the gain medium allow rapid removal of heat from gas lasers, solid state and fiber lasers must rely on a combination of conduction and convection. This difference constrains the size of the output aperture, and therefore the power, of solid state and fiber lasers. This paper examines the tradeoffs which govern the relation between high power and good beam quality in these classes of lasers.

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