Physics Department Senior Design Project Proposal

Project Primary Mentor:
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Project Title:
LED-pumped solid state lasers

Project Type: [X] Team; Number of students 2 [ ] Honors

Objective
Solid state lasers are optically pumped, typically with discharge lamps or laser diodes. We are working on a new concept of using pulsed light-emitting diode (LED) arrays to efficiently pump lasers. The LEDs are inexpensive and can produce a large amount of optical power that can be efficiently be absorbed into the laser gain medium. Students working on this project will be able to work on developing a new class of lasers, and will learn how to design and analyze a laser system. When working, this type of laser will have numerous applications, including as a pump source for ultrafast Ti:sapphire laser systems. One student will work on LED pumping of Cr and Ce sensitized laser materials, while the other will work with a solid-state dye laser material.

Prior Background
This is a project that Steve Hill and I have been working on for the past 6 months, and have made some progress on during the summer. A couple of graduate students have helped with initial modeling, machining and alignment.

Student Expectations
The students are expected to design and fabricate the pump chamber, improve on and package the LED pulsed power supplies, and make measurements to characterize the gain of the material and the parameters of the laser system. Schematics and drawings will be required to document the work. The project will involve work in the machine shop, electronics, optical alignment, parts design and some Arduino programming. Taking the courses in Laser Physics (PH480, fall) and Optical Systems Engineering (PH4xx, spring) is strongly encouraged.

Supervision Plan
The principal direct supervision will be by Steven Hill, will close interaction with the mentor, Chip Durfee. There will also be a graduate student working on this project part time.

Resources
We have built a preliminary pump chamber and LED power supply and controller, as well as a test laser cavity. There is some modeling code developed by the mentor and his students that will help in the design. Equipment for the Laser Physics class is available for testing and diagnostics. A modest budget is available for parts and optics.

Technical References