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Acousto vs. Electro Optic Modulators in Short pulse, high peak power Q-switched lasers

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Abstract content
 (Max 300 words)

Compact short pulse high peak power lasers are highly sought after in ranging applications. This research seeks to develop an actively Q-switched source which emits peak powers of ~ 10 kW in 1 ns at 100 kHz since there are almost no such commercial sources available with these optimum parameters. To obtain such short Q switched pulses a high gain material must be end-pumped with high intensity diode laser beams and have a fast Q-switch. Traditional switching methods that can be used are Acousto- Optic Modulators (AOMs) and Electro Optic Modulators (EOMs).

An AOM uses an RF generated acoustic grating to diffract light out of the cavity, inducing a variable loss, which Q-switches it. The advantages are that AOMs do not require high voltages, are usually polarisation insensitive and well understood. However, the switching speed is limited by the speed of sound through them and their restricted modulation depth often causes hold-off problems.

EOMs have traditionally been shunned because they require high voltages (causing EM noise when not well shielded) and ringed, which caused a loss when the EOM is switched off. EOMs use the Kerr effect to rotate the polarization which, in addition with polarizing elements, causes a varying loss within the cavity. This makes it possible to switch very fast since the switching time depends only on the high voltage source (~ 1 ns or shorter). They are also compact and have a high extinction ratio, eliminating the hold-off problems of AOMs.

The aim of this study is to directly compare the performance of AOMs and EOMs as Q-switching elements for high peak power, short pulse lasers and to identify the regimes where each can be effectively and economically used. Results highlighting the limitations of AOMS will be shown, as well as initial results from an EOM Q-switched laser.

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PhD

Main supervisor (name and email)
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Dr. H. J. Strauss

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