Submitted to 10th AIP Condensed Matter Physics Meeting Wagga-Wagga 5th-7th Feb '86.

Q-SWITCHING AND MODELOCKING OF A NEODYMIUM-DOPED MONOMODE FIBRE LASER AT 1.08μm AND 906nm

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Abstract

There has recently been great interest in the use of rare earth-doped monomode optical fibre in high gain laser systems. The monomode fibre geometry confers a low threshold for laser operation, so that compact and highly efficient devices using semiconductor diode laser pumping can be constructed. Moreover the strong inhomogeneous broadening of the rare earth transitions in the glass fibre offers the possibility of broadband tunable operation.

We have made the first demonstrations of Q-switching and modelocking in a monomode fibre laser, using a neodymium-doped fibre operating at 1.08μm. The fibre was pumped by 75mW of absorbed optical power from a continuous-wave dye laser tuned to a neodymium absorption peak at 590nm. In Q-switched operation an intracavity acousto-optic modulator was used to switch pulses of 200ns duration and 8.8W peak power at repetition rates up to 1kHz. Active modelocking of the fibre laser was accomplished using acousto-optic modulation of the cavity losses at 41.4MHz. Preliminary studies have established an upper limit of 2ns on the modelocked pulse duration, and work is in progress to gain a precise measurement.

We have also shown that the neodymium-doped fibre laser can readily be operated continuously at 0.906 μm, in spite of the fact that at room temperature the terminal levels of this laser transition are thermally populated. This contrasts with previous studies in which the 0.9μm Nd^{3+} transition has been shown to lase only in pulsed mode, and illustrates the effectiveness of the intense pumping radiation fields generated by confinement within the fibre waveguide core.

ACT/JCHA
28 November 1985