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New Generation of Cladding Pumped Fibre Lasers and Amplifiers

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Abstract: In this talk we discuss recent developments in high power fibre lasers and amplifiers. Particular attention is paid to pump launching schemes and methods to minimise nonlinear distortion in fibre amplifiers.

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Diode-pumped fibre lasers and amplifiers have firmly established themselves as a reliable source of multiwatt radiation in near IR region. Average power in excess of 100 W [1] and pulse energies above 2 mJ [2] are now available from fibre based laser sources.

High brightness high power pump is a key component in high power fibre-based devices. Currently available diode sources are powerful enough to pump a 100 W fibre laser even in traditional end-pumping scheme [1]. Further power scaling in this configuration becomes problematic due to significant difficulties in spatial separation of pump and signal beams.

There are several elegant solutions to this problem which include multimode pump couplers [3], the v-groove technique [4] and side pumping [5].

In this talk we will discuss advantages of a new technique based on single clad coiled fibres [6]. In this structure the pump waveguide of the active fibre is directly accessible from the side so that pump light travelling in separate pump fibers can directly couple over into the doped fibre. This technique is very flexible and offers multipoint pump injection. Also it equally applicable to medium (1-3 W) and high (> 10 W) power fibre based devices.

For high-energy devices (both amplifiers and Q-switched lasers) the challenge lies in founding core designs that can store a large amount of energy before self-saturation and spurious lasing between pulses limits further storage. The solution is to use a large core. This also increases threshold of unwanted nonlinear effects such as SBS and SRS. The downside is that beam quality degrades, as the core becomes multi-moded. We will discuss several solutions to this problem including application of complex refractive index profile [2] and tapered fibre filters [7]

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