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Coherent Beam Combination for Laser Fusion Driver design using Rotation Wedge Self-Phase-Controlled Stimulated Brillouin Scattering Phase Conjugation Mirrors

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Laser fusion drivers requires around 40 kJ@10 ps laser for fast ignition. However, it is hard to produce such a high energy, high repetition rate laser because of the thermal problems. The output energy of current high repetition rate laser projects is at most 100 J, even with using the most advanced laser technologies. A coherent beam combining is one of the most promising technique to achieve such a high energy and high repetition rate laser. It has been shown experimentally that the coherent beam combination using self-phase-controlled SBS-PCMs is the simplest coherent beam combination method. Furthermore using a high energy and high repetition rate ns beam combination laser, a high energy, high repetition rate fs/ps laser can be generated by optical parametric chirped-pulse amplification (OPCPA). And so the laser fusion driver can be developed using the coherent beam combination laser.

The authors proposed the 0.5 MJ@ 10Hz practical LIFE (Laser Inertial Fusion Energy) driver. The LIFE driver is composed of 192 beam lines similar to NIF, a single beam line would have to produce at least 2.5 kJ@ 10Hz. It is suitably achieved by coherent 25 beams combination of 100 J double pass amplifier modules having SBS-PCM. For 100 J modules, its SBS-cell focal spot load is over 100W. Rotating wedge SBS-PCM should be used to relief the thermal load in the SBS-cell focal spot. To reduce the thermal load in the SBS-cell focal spot, the rotating wedge self-phase-controlled SBS-PCM can be applied.

With the rotating wedge self-phase-controlled SBS-PCM, a real LIFE driver having a high energy, a high repetition rate can be developed through the coherent beam combination.

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Primary author: Prof. KONG, Hong Jin (KAIST)

Co-authors: Dr KIM, Jom Sool (Laser Spectronix); Mr OH, Jungsuk (KAIST); Dr CHURN, Kilsung (KAIST); Mr PARK, Sangwoo (KAIST); Mr CHA, Seongwoo (KAIST)

Presenter: Prof. KONG, Hong Jin (KAIST)

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