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Milan Kalal

Faculty of Nuclear Sciences and Physical Engineering Czech Technical University, Prague

Current status of SBS PCM based self-navigation of laser drivers on IFE pellets injected into the reactor chamber

Current status of a recently proposed novel approach to inertial fusion energy (IFE) technology, where phase conjugating mirrors (PCM) generated by stimulated Brillouin scattering (SBS) are employed in order to implement an automatic self-navigation of every individual laser driver onto injected IFE pellets, will be reviewed. This novel technology is of a particular importance to the direct drive schemes of pellet irradiation, which is the basis of a number of IFE projects. If successful in its full scale realization, this automatic aiming scheme would greatly reduce the current technical challenges of adjusting large and heavy optical elements (final mirrors located in front of an IFE reactor) during each shot with a typical repetition rates of several Hz in order to achieve the required level of aiming accuracy of the order of about 20 micrometers. In order to make this self-navigating technology working properly, a special target displacement compensation system was designed. This design is specific for every individual laser driver according to its direction of propagation inside of the reactor with respect to the trajectory of the injected pellets. This self-navigation technology was already tested experimentally on a smaller scale and proved is functionality. Featuring no moving parts, this technology would allow for a high number of laser drivers to be employed. Operating with lower energies (EL < 1 kJ per driver) a potential damage caused by perpendicular SBS to the entrance windows (as encountered in classical irradiation schemes, e.g., at NIF) which needs a special attention would be non-existent. The latest achievement in the gradual step-by-step development of this technology is a conceptual design for the removal of the unconverted basic laser harmonic. This is needed since the corresponding schemes already developed to deal with this issue (e.g., for LMJ or NIF) are not applicable in the SBS PCM IFE technology. Hence a special Faraday insulator was proposed. For the basic harmonic propagating in both directions (to be removed on its return) this insulator will work in its classical configuration. However, the higher harmonic (propagating only in the backward direction towards the reactor) will be allowed to pass through the insulator and enter the reactor. Having the unconverted harmonic removal problem solved, a serious development of the SBS PCM based laser driver can be started to establish an upper limit of energy at which the required laser beam parameters would be still of an acceptable quality. It is very convenient that for these tests only one laser driver is necessary, thus much easier to do such research.

Biography

Milan Kalal did his Ph.D from Czech Technology University, Czech Republic. His achievements includes invention of complex interferometry technique, allows to obtain up to 3 sets of data from just one (complex) interferogram. Invention of introducing new mathematical special functions especially suited for very fast and very accurate calculation of the Abel Inversion transformation. First to Finding analytic solutions of the Vlasov equation (1985) for electromagnetic fields with arbitrary amplitude (in the form of differential operators in the velocity space).

kalal@troja.fjfi.cvut.cz