MATTER AND TECHNOLOGIES

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Optimisation of Inverse Compton Scattering via spatiotemporal tailoring of scattering pulse

All-optical High-energy X-ray (HEX) beam sources based on Inverse Compton scattering constitute a promising alternative to conventional X-ray sources due to their compactness and tunability. These X-rays are generated through collision between a laser pulse and relativistic electron beams produced by a laser-plasma accelerator. Although a low HEX bandwidth is required for many applications, all-optical ICS sources have up to date demonstrated bandwidths on the order of only tens of percent.
The parameters of the electron beam have been optimized in past research to minimize its contribution to the bandwidth; the scattering laser pulse now remains the biggest contribution to the large bandwidth, therefore it needs to be optimized as well.
In this work we aim to shape the scattering pulse by generating a "Flying Focus", a focusing scheme where a chirped laser pulse combined with a chromatic focusing system enables having different laser frequencies focusing at different distances thereby allowing the high intensity peak to interact with the electron beam for extended distances.
Such optimization of the focus, needed to precisely match the laser pulse with the electron beam, can lead to reductions in the X-ray bandwidth and to the production of a high number of photons. Our work enables the development of a tunable X-ray source that can be used in various fields and applications such as non-destructive testing of large/dense objects and k-edge subtraction imaging.

Speed talk:

I am unwilling/unable to present a speed talk

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