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Modulations on Thomson parabolic-like ion-patterns caused by laser-matter produced ElectroMagnetic Pulses

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When a high-intensity laser interacts with matter, many processes lead to the generation of intense electromagnetic fields, in a spectrum ranging from MHz to THz, known as electromagnetic pulses(EMPs). The effects of the EMPs on the instrumentation are long-time studied topic, especially in laser-driven ion acceleration or nuclear-fusion experiments.
We studied the evidence of such fields on the Thomson Parabola(TP) spectrometer used for the detection of the mass-to-charge ratio and energy spread of emitted ion beams in laser-matter interaction experiments. This detector separates particles by their mass-to-charge ratio and their energy using electrostatic and magnetostatic fields, producing characteristic parabolic traces. Spurious EMPs affect the static fields inside the TP, causing ripples in the particle traces. From the analysis of the ripples, we could retrieve the relative intensity and the temporal evolution of the intercepted EMP. In the same shot, we measured the electromagnetic signal captured by the TP-electrodes, which acts as a voltage variation between them, and the particle traces imaged in the detection plane of the TP.
This analysis leads to a temporal and spectral analysis of the emitted fields, giving a new tool for a deeper insight into the laser-plasma interaction dynamics and the generation of the EMPs.

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