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Towards a single-shot diagnostics of ultra-short lasers for THz pulse shaping in optical rectification experiments

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THz radiation is nowadays of great interest for a variety of applications e.g. to study the non-linear response of new materials, medical purposes, particle acceleration etc.. Regarding THz-based particle acceleration, the schemes explored to date make use of a direct interaction: THz-electrons. The THz radiation is generated through the optical rectification process induced in non-linear crystals by a pump laser. The optical rectification is a second-order process able to convert an infrared pump laser to the THz domain (0.5-10THz). The temporal shape of the pump laser and in general its characteristics are important aspects to be known in order to produce THz radiation via optical rectification in a controlled way, especially for single shot experiments. Here we present a technique that can be used to retrieve the pump laser temporal profile characteristics (envelope and phase), starting from the detection of the THz waveform/spectrum and the knowledge of the physical/optical properties of the crystal used to produce it. We show experimental examples of THz production via optical rectification and we show how we can reconstruct the pump temporal profile. Furthermore we highlight the pros and cons of this technique.

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