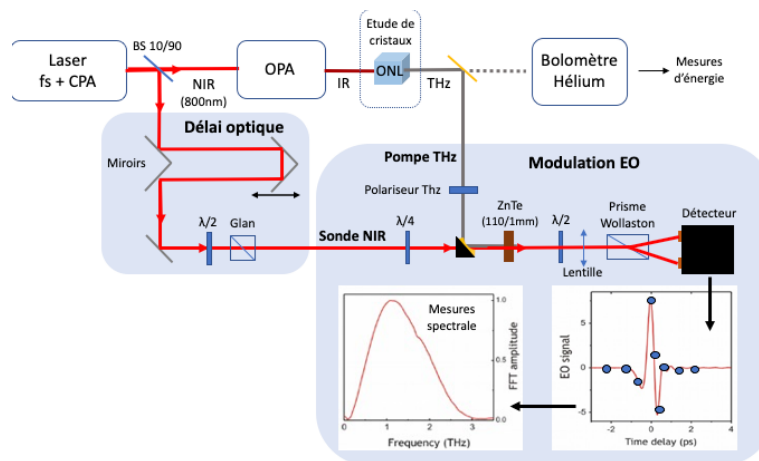


### Implementation of a Fourier Transform spectrometer to record the spectrum of a THz light generated in new nonlinear crystals

**General Scope:** the scope of this internship is to implement a Fourier Transform (FT) spectrometer designed to record the spectrum of a tunable and energetic THz light. It is generated in new nonlinear crystals with non-linear optical properties, by a second-order frequency differences (DFG) between two Fourier components of a wavelength-tunable femtosecond pulse. Such a THz spectrum corresponding to the frequency range 0,1 - 20 THz *i.e.* to the wavelength range 3000 - 15  $\mu\text{m}$ , is of prime importance for many applications as spectroscopy and medical for example.

**Research topic and facilities available:** we have the commercial wavelength-tunable femtosecond source and we implemented a THz bench with all the optical components needed for the beams routing and a bolometer to record the mean value of the THz energy generated. We need an analysis of the corresponding THz spectrum. We targeted a FT spectrometer based on a time correlation between a probe pulse (femtosecond) and the THz pulse (picosecond) which, in a ZnTe crystal, will induce an electro-optical effect (EO) via its own electric field as shown in the figure below. A FT of this time-correlation will directly provide the spectrum of the THz pulse.



Such a spectrometer is found in laboratories working in the THz domain. We acquired and will have received at the beginning of the internship all the necessary optical and opto-mechanical components, to implement this FT spectrometer.

**Collaboration and networking :** This spectrometer will be implemented by the OPTIMA team with David Jégouso from the OPTICS-and-MICROSCOPY technical team of NEEL Institute. We will be carrying out a technology transfer from the team of Frédéric Gareth and Emilie Héroult of IMPEP-LAHC in Chambéry with whom we have been collaborating for several years. The used nonlinear crystals for THz generation from DFG were provided thanks to international collaborations.

**Required skills:** optics, nonlinear optics and lasers. **Starting day** February 2024

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