INTERNSHIP PROPOSAL

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Thesis possibility after internship: YES
Funding: YES If YES, which type of funding: ANR

Phase modulators for quantum optics in the mid-infrared

An electro-optic modulator is a device allowing the modulation of a beam of light by means of an applied electrical signal. The modulation can be imprinted on different properties of the light beam: amplitude, phase, frequency or polarization of the beam. They are essential in several applications like telecommunications, image projections, displays. Phase modulators are extremely important in quantum technologies: they are used to produce entangled light states in photonic platforms, or to optically address and/or prepare quantum bits.
While they are commercially available in the visible and near-infrared range, electro-optic modulators are at their infancy as far as mid-infrared wavelengths are concerned. Recently, our group has developed an amplitude modulator based on the Stark effect in a system of tunnel coupled quantum wells. This device allowed us to realize a data transmission experiment in the free-space, with record bitrate.[1,2]

The aim of this project is the realization of phase modulators in the mid-infrared.[3,4] Such devices will be implemented in a waveguide geometry, and they will be exploited to realize a Mach-Zehnder interferometer. Combined with a sensitive mid-infrared detector, such interferometer would be the first building block for a fully integrated heterodyne detection[5] platform, opening the path towards extending the realm of quantum optics towards the mid-infrared domain.

References

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Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: YES Soft Matter and Biological Physics: NO
Quantum Physics: YES Theoretical Physics: NO