Master 2: ***International Centre for Fundamental Physics***

INTERNSHIP PROPOSAL

(One page maximum)

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Thesis possibility after internship: YES
Funding already obtained for a PhD: NO If YES, which type of funding:

Improvement of ZnGeP2 crystals for infrared laser applications

Summary

High power and tunable infrared (2-12µm) lasers are important sources for defense/civil applications such as laser counter-measure to jam missile camera or long range remote chemical species detection. Indeed, that wavelength range includes atmosphere transparency bands (2-5 µm and 8-12 µm). Infrared laser sources are based on non-linear optics: a pump laser (1 or 2 µm) is converted into tunable 3-12 µm laser emissions thanks to single crystals with appropriate properties. One of the best crystals for this kind of applications is ZnGeP2 (ZGP) but their optical quality must be improved to increase the laser yield. Different kind of defects can appear during the growth process: inhomogeneity, punctual defects,...
In the present study, we propose two ways of improvement:
First, previous studies have shown that tin doping into ZGP (patented) increases significantly the optical performances. The goal would be to further study this ion doping on the transparency and laser properties.
Second, some punctual defects as ion vacancies are responsible for the residual absorbance at 2 µm (the pumping wavelength). Recent tests on the SIRIUS electron irradiation facility at the Ecole Polytechnique showed that this absorption decreases drastically. Based on these results, it is therefore useful to study the possible effects of the irradiation conditions on the transmission properties. In particular, the study of the effects of the flux and of the irradiation temperature could allow to improve the final transmission properties and to obtain more information on the processes of generation and destruction of defects. The characterization of the effects of irradiation on the transmission properties may be accompanied by spectroscopic measurements such as Electron Paramagnetic Resonance (EPR) to improve the knowledge on the defects. The goal is the improvement of the property in the irradiated samples and of the understanding of basic physics of the defects responsible for absorption.

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