

Post-doc Position

(Released date: May 09 2019)

Crystalline Lens Modification by Ultrafast Laser Pulses for Vision Recovery

Duration: 18 month, available immediately

Group: Lab Hubert Curien, Manutech-USD, and BiiGC, in St-Etienne, France

Background

Laser sheds light upon various human vision correction practices, such as corneal grafting, myopia, hyperopia and astigmatism corrections, lens replacement etc. Ultrafast laser pulses are regarded as a unique branch of laser tooling, used in many different eye surgery processes ¹. Due to its quasi-athermal and non-linear dynamics, ultrafast laser can be used to treat not only a surface but also three dimensionally inside the bulk. It is reasonable to assume that potentials exist to address certain crystalline lens related vision impair (i.e. presbyopia) by ultrafast laser pulses ². It is one of the challenges to be taken up within the framework of EAgle (Acronym for Eye Anterior segment Laser Engineering) project.

Objectives

The accommodation capacity of the crystalline lens degrades as part of human/animal ageing process. This deformation-ability is to be improved using ultrafast laser through, among other possible pathways, laser micro-scissions, photo-chemical and/or photo-biological reactions. The ultimate goal is to recovery elasticity of the lens by ultrafast laser induced bulk modification of the lens. This exploratory research will encompass experiment design, system setup/calibration, performing test and results analysis.

Candidate's profile

Given the multi-disciplinary nature of the research, the successful candidate must be a team player, results-driven, and self-initiator. He/she should hold a doctorate degree in physics/optics, with a good track record in laser material interactions, especially ultrafast lasers, and transparent/biological materials. Experience upon laser temporal/spatial shaping ^{3,4}, and optics design is highly appreciated. Sufficient skills in material science are also required to ensure a good level of exchange with partnership ophthalmologists and biologists. To this end, knowledge in French (or high motivation for learning) is considered as an advantage.

Practical information

Location: The hosting lab (Hubert Curien), experiment center (Manutech-USD), and collaborator (BiiGC) are all based in Saint Etienne, eastern central France. Saint Etienne city is of 3-hour's train distance from Paris, or of 45 minutes from Lyon. It is also near the Pilat massif and the Alps, close to excellent hiking trails and ski resorts.

Remuneration: Net monthly salary 2000~2500€, depending on experience and skills.

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References

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- (2) R. Krueger, XK. Sun, J. Stroh, R. Myers, Experimental Increase in Accommodative Potential after Neodymium: Yttrium-aluminium-garnet Laser Photodisruption of Pared Cadaver Lenses; Ophthalmology, 108 (2001) 2122-2129
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- (4) VK. Velpula, M. Bhuyan, C. Mauclair, JP. Colombier, R. Stoian; Role of Free Carriers Excited by Ultrafast Bessel Beams for Submicron Structuring Applications; Optical Engineering 53(2014) 076108