Killing Star Light to See Planet B

SUMMARY.
In this METEOR, the student will participate in the testing and development of a new type of stellar coronagraph, whose focal plane mask is based on a programmable liquid crystal array, able to find companions around binaries or more complex structures. The project will take place in Switzerland, at the University of Applied Sciences Western Switzerland in Yverdon-les-Bains (HEIG-VD) and the Center for Space Habitability of the University of Bern (UBE), where the stellar coronagraph - PLACID - is being built for an installation on a 4 m telescope in East Anatolia (DAG project) at the end of 2022. The internship will consist in working with the team to explore the limits of this novel technique, via modeling and laboratory testing.

OBJECTIVES

- Learning to work with an engineering and science team in the context of an astronomical instrument development. The student will learn about optics, optics laboratory and optical system modeling, all in collaboration and with the guidance of experts in the field of optics and instrumental astrophysics. The student will also have the opportunity to see how an instrument project is managed.
- From the many exchanges with the coronagraph development team, the student will be able to gain independence and maturity in the development of a research program, by being able to make use of existing academic knowledge and other peoples' skills.

PREREQUISITES

- Fourier optics
- Numerical methods (coding)
- Signal/image processing

THEORY

In this METEOR, theory will be limited to optical propagation, and the theory that will be needed will be developed during the internship.

APPLICATIONS

Beyond working in the PLACID coronagraph model, the student will also continue the development of an earlier research that was started by a previous METEOR group: a deep analysis of the impact of optimal turbulence and noise on the images of a stellar object, from the simplest case of a seeing limited observation to the most complex, i.e. an adaptive optics fed coronagraph. Thanks to these first simulations, our group has been able to understand better the need for AO in the context of a coronagraph, but there is still much to do to push the analysis further. At the end, this understanding will be used in the development of the DAG coronagraph reduction software, so this research is critical for the success of PLACID observations.

MAIN PROGRESSION STEPS

- getting to understand about coronagraphs and extreme adaptive optics, by discussions with the team and literature study; understanding previous METEOR work and results;
- continue to push forward the research on coronagraph limitations; simulating PLACID and laboratory verifications;
- Documenting the results, preparing for an oral presentation.

EVALUATION

The evaluation will be done via an oral presentation and the project's results report.

CONTACT

☎ +41 24 557 6421 (Prof. Laurent Jolissaint, Yverdon-les-Bains)
✉ laurent.jolissaint@heig-vd.ch