METEOR Astronomical Adaptive Optics (AAO)

SUMMARY.

All modern optical telescopes include adaptive optics (AO) systems in order to get rid of angular resolution degradation due to atmospheric turbulence. In that sense, this METEOR has fundamental connections with all major nowadays instruments — on 8-m class telescopes such as VLT, LBT and Gemini, and extremely large telescope (ELT) projects. After the theoretical part, initial studies will be performed in the framework of the AO system being conceived for one of the 1-m C2PU telescopes. Then, custom-made applications for larger apertures (either 8-m class such as VLT or LBT, or the european ELT) will be tackled following a choice made with the student.

OBJECTIVES

The expected expertise/skills acquired during this METEOR are: knowledge of the theoretical and practical basics of astronomical AO, including laboratory experimentation of wavefront sensing, dimensioning of an AO system, post-AO imaging, and numerical detailed modelling of the main types of AO systems for astronomy (standard AO, extreme AO, wide-field AO).

PREREQUISITES

(1) Fourier optics ; (2) Atmospheric turbulence, image formation, and introduction to adaptive optics ; (3) Numerical methods.

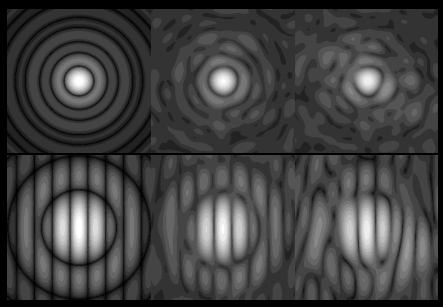
THEORY

by Marcel Carbillet & Aziz Ziad

The scope is to provide a global introduction to AO for astronomy, laboratory practice with wavefront sensing, practice with AO systems dimensionning and numerical modelling, including wavefront correction, loop control, detector characteristics, performance evaluation. Post-AO imaging will also be tackled.

APPLICATIONS

by Marcel Carbillet



The application part of this METEOR will focus on detailed numerical modelling and performance evaluation of a standard AO system, an eXtreme AO (XAO) system with application to exoplanets detection, and a Ground-Layer AO (GLAO) system for wide-field astronomy. For pedagogical concerns, initial studies will be performed in the framework of the AO system being built for one of the 1-m telescope of C2PU, for the visible and the near-infrared, and including performance evaluation of a near-infrared XAO system and a GLAO system. Custom-made applications, chosen in function of the interests of the student, will be rather performed in the framework of large aperture telescopes, either in monolithic or interferometric mode, considering either stellar (possibly laser-based) or solar AO, etc.

MAIN PROGRESSION STEPS

First part: theoretical courses. Second part: applications. Last week : preparation of the oral presentation.

EVALUATION

Theoretical part: a report on the laboratory measures, and a report on the dimensionning and numerical modelling of a generic AO system.
Application part: a report on the different numerical modelling studies performed for XAO and GLAO systems, and a report on the custom-made application chosen.

BIBLIOGRAPHY & RESSOURCES

Material for this METEOR.
Numerical modeling tool used (CAOS).

CONTACT

☎ +33 4 89 15 03 33 (M. Carbillet)
✉ marcel.carbillet@unice.fr