Astronomical Optics & Instrumentation

METEOR Astronomical Adaptive Optics (AAO)

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.

Adaptive optics for Astronomy

by Marcel Carbillet, Aziz Ziad, Jean-Pierre Folcher (Lagrange), and Bruno Valat (Thalès)

The theoretical part of this METEOR will provide a global introduction to AO for astronomy, laboratory practice with wavefront sensing, specialized courses for AO loop control and for detectors, practice with AO systems dimensionning and numerical modelling, including wavefront correction, loop control, detector characteristics, performance evaluation. Post-AO imaging will also be tackled. Hereafter is an overview of the theoretical teaching: (1) Global introduction to AO for astronomy ; (2) Wavefront sensing in real life ; (3) Introduction to AO loop control ; (4) Detectors for wavefront sensing and post-AO imaging ; (5) Generic AO system dimensionning and modelling ; (6) Post-AO imaging.

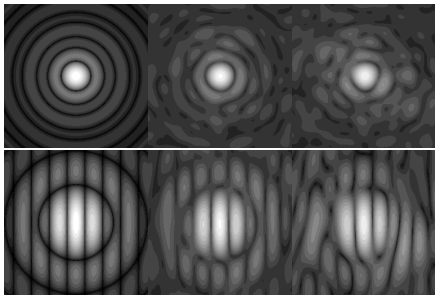
The evaluation mode for this theoretical part is based on: a report on the laboratory measures performed, a report on the dimensionning and numerical modelling of a generic AO system, including wavefront sensing and reconstruction, loop control, and post-AO imaging.

AO systems numerical modelling and performance evaluation

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, including XAO and GLAO. Custom-made applications, chosen in function of the interests of the student, will be rather performed in the framework of either an 8m-class telescope (VLT, LBT) or the E-ELT. Hereafter is an overview of the practical part of this METEOR: (1) Detailed study of a standard AO system for the visible and the near-infrared ; (2) Performance evaluation of a near-infrared XAO system ; (3) Performance evaluation of a GLAO system ; (4) Custom-made application for a large or extremely large aperture.

The evaluation mode of this theoretical part of the METEOR is based on: a report on the different numerical modelling studies performed for standard AO, XAO, and GLAO systems, and a report on the custom-made application chosen.



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

See also

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

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