Adaptive Optics for High Contrast Imaging : from NACO to PCS

Jean-Francois Sauvage[*1]

[1]ONERA – ONERA – France

Abstract

High contrast imaging is an very demanding instrumentation domain allowing to capture the few photons of a companion orbiting a very bright star. From this image, huge and numerous information can be driven as the chemical composition of atmosphere, presence and structure of clouds, temperature. Multiplying these measurement in survey operation allows to understand the formation of exoplanets. High contrast imaging requires a extreme control of optical aberrations in the system, each uncontroled residual leading to the creation of a bright speckle in the image, that astronomer can easily misunderstand as a companion. In particuler the adaptive optics required for these system needs very high performance. I am presenting in this talk the evolution of the AO system designed and used to perform high contrast imaging since the old ages of NACO in 2001 to SPHERE in 2014, analyse their limitation on sky and how we build on the past to prepare the future. In particular I analyse the major change of WFS technique from Shack-Hartmann to Pyramid. In parallel I focus on the strong impact of the telescope environment. Every time a new AO system comes to a telescope, more performant than the previous one and build on the experience feedback from the previous integration times, it turns a new eye on the telescope environment. We discover then new challenge that were hidden previously in the residuals of the previous system. I analyse and draw the history of these performance evolution through the years, showing how each system builds on the previous one and brings its own feedback for the next, and how the research activities feeds the system developments.

[*]Speaker