Adaptive tunable kernel-nulling interferometry for the direct detection of extrasolar planets

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The direct detection of exoplanets is very challenging due to the extreme resolution required, both angular and in contrast. Among several technics, nulling interferometry [1] seems to be a very promising technique. However, the performance of current devices is limited by the sensitivity to any phase aberrations. The work presented here attempts to overcome those limitations by using a four-telescopes nulling interferometer architecture, called Kernel-Nuller [2], which includes a recombiner that positions the four acquired signals in phase quadrature. This architecture is based on an integrated optical component containing 14 electronically controlled phase shifters, used to correct optical path differences that would be induced by manufacturing defects. The first part of the study consists in the development of an algorithm providing the delays to be injected into the component to optimize the performance of that device. The next step of this study deals with the analysis of the intensity distributions produced at the output of the Kernel-Nuller [2,3] through a series of observations, and then apply statistical tests and data treatment techniques to detect the presence of exoplanets.

References

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