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TÍTULO:
INTEGRATED OPTICS IN THE MID-INFRARED: APPLICATION TO NULLING INTERFEROMETRY FOR THE DETECTION OF EARTH-LIKE PLANETS

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RESUMEN/ABSTRACT:

This work was devoted to extend the solution of integrated optics in the mid-IR for space-based nulling interferometry applications in the context of searches for earth-like planets.

Nulling interferometry, a coronographic technique used in astronomy, is the core of the ESA Darwin mission dedicated to the direct detection of extrasolar earth-like planets. This technique requires a very stable optical system for the combination of multiple beams. Moreover, the scientific objectives require the use of modal filtering of the incoming beams. This thesis focuses on the development of mid-infrared integrated optics (IO) that can perform both combination and modal filtering functions. The initial context is thus the extension of single-mode IO from the near-infrared to the mid-infrared range, which corresponds to an important spectral domain for planet searches. After a description of nulling interferometry requirements, I present the fundamental guided-optics notions used to study the dielectric waveguides and the hollow metallic waveguides solutions.

Moreover, I discuss the issue of coupling light into the waveguide. The lab characterization work at 10 microns has involved the implementation of dedicated methods and breadboards in the

mid-infrared, which permitted me to demonstrate the waveguide and the single-mode behavior of the first manufactured structures. The preliminary measurements of the signal extinction have also shown the importance of pursuing this technological research for purposes of modal filtering. Mid-infrared integrated optics has now reached a new and important step and will contribute, on a mid-term basis, to the implemetation of nulling interferometry.

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