Next-Gen Tricoupler Device for Exoplanet Detection

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Nulling interferometry was proposed back in the 1970's and has since proven to be a promising technique for imaging exoplanets, overcoming the contrast and angular resolution limitations of single telescopes. This technique is used by the GLINT instrument at the Subaru telescope in Hawaii utilising the SCExAO extreme adaptive optics system [1]. An upgrade to GLINT will use 3D tricouplers to simultaneously achieve nulling and preform fringe tracking to provide the needed high contrast at small angular scales to detect exoplanets. We present laboratory characterisations of 3D tricouplers (Fig 1a) fabricated by ultrafast laser inscription. The ideal tricoupler for GLINT has an equal splitting ratio between each waveguide. Coupled mode equations are numerically solved (Fig 1b) to determine coupling coefficients and dephasing parameters, based on which the fabrication parameters are improved to achieve a perfectly symmetric device.

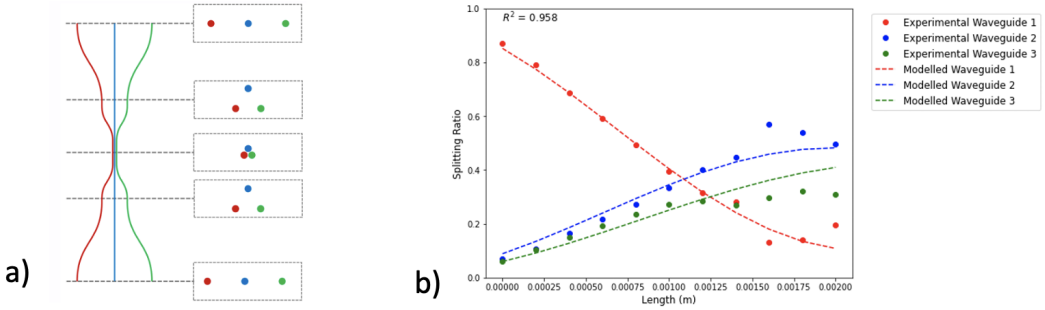

Figure 1: a) Detailed waveguide geometry of the tricoupler b) Splitting ratios of a 1550nm tricoupler as a function of length written at a feedrate of 960mm/min and a -0.5μm offset to the second waveguide.

[1] M. A. Martinod et al, *Scalable photonic-based nulling interferometry with the dispersed multi-baseline glint instrument.*, Nature Communications **12** (2021).