DIRECT DETECTION OF EXOPLANETS USING TUNABLE KERNEL-NULLING

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Abstract

This thesis proposes an innovative approach, tunable Kernel-Nulling, for high-contrast imaging of exoplanets. Using integrated optics technology with electronically controlled phase shifters, the method asymmetrically modifies the nuller's response, allowing the discrimination of astrophysical signals from diffraction-induced speckles. The device's performance optimization involves machine learning techniques, initially in a controlled setting and later in realistic observing conditions. This approach promises to significantly enhance interferometric high-contrast imaging, providing a powerful solution for achieving deep and robust observations.

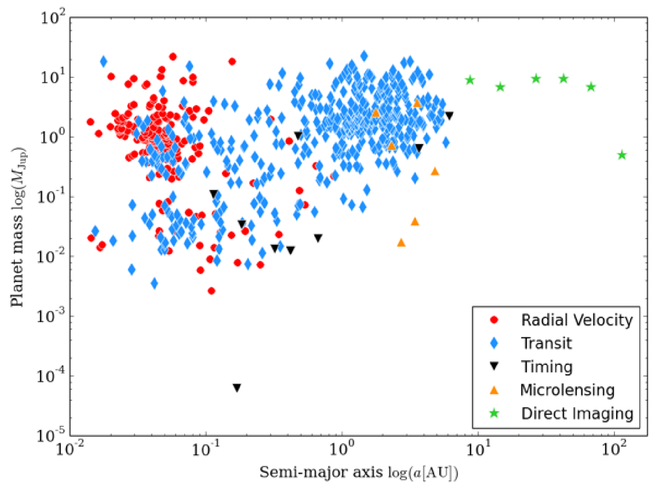

Figure 1: MeDetections per method. By Paul Anthony Wilson - Exoplanet detection techniques

Context

Nulling interferometry

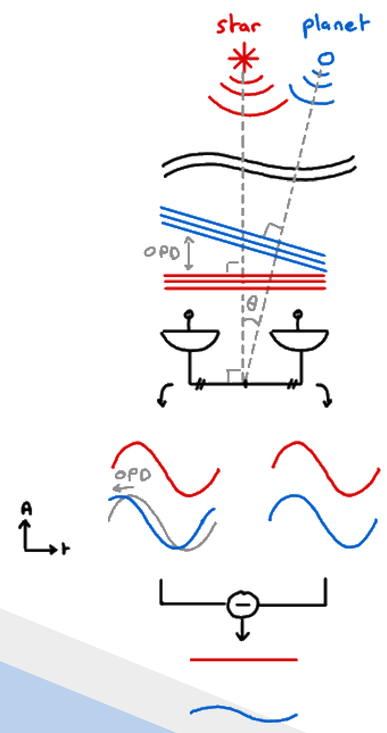

Figure 2: Illustration of the Nulling principle.

By synchronizing the phase of the star light collected by two (or more!) telescopes, it is possible to cancel the star's light. As the star companion is not on the line of sight, it's phase will not be perfectly synchronized and will not be canceled. This is the principle of nulling interferometry.

Our architecture

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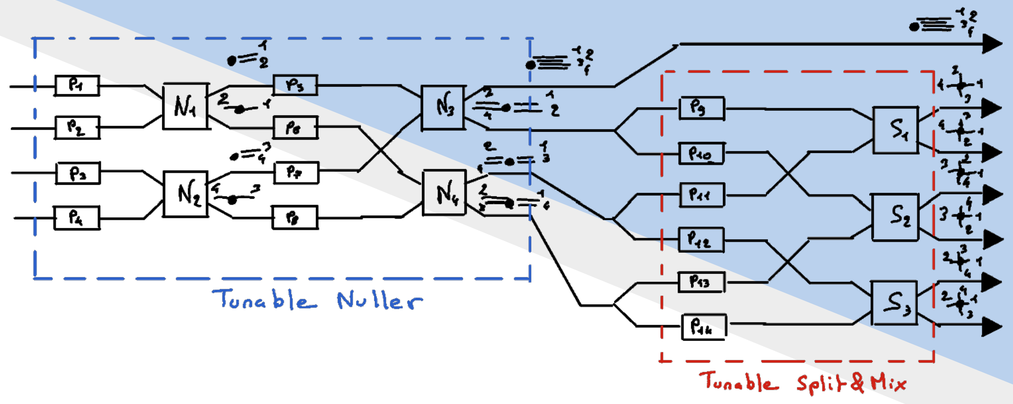

Figure 3: Scheme of our architecture.

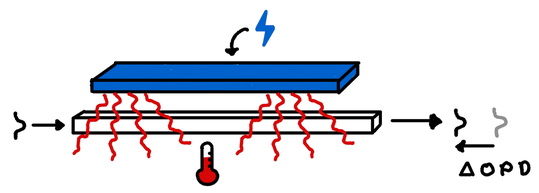

Figure 4: Thermo-optic phase shifter.

[2].

Results & discussion

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Table 1: *Corpus* utilizados no estudo

Corpus	Caracteres únicos	Total de linhas	Total de caracteres
SBSEThesis	88	2.311	771.179
Bible	63	32.359	3.924.374
JavaCode	69	436.565	12.053.424

[1]

Acknowledgements

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References

[1] F. Chollet et al. Keras. `https://github.com/fchollet/keras`, 2015.

[2] R. Just, D. Jalali, and M. D. Ernst. Defects4j: A database of existing faults to enable controlled testing studies for java programs. In *Proceedings of the 2014 International Symposium on Software Testing and Analysis*, ISSTA 2014, pages 437–440, New York, NY, USA, 2014. ACM.