Painting with starlight : optical techniques for the high-contrast imaging of exoplanets

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Propositions accompanying the thesis

Painting with Starlight

Optical techniques for the high-contrast imaging of exoplanets

1. Holographic optical techniques such as the coronagraphic Modal Wavefront Sensor provide a powerful and versatile tool for customising the information content delivered by science images. *(Chapter 2)*

2. The low-wind effect seen in the SPHERE instrument can be eliminated using focal-plane wavefront sensing techniques requiring no additional hardware, if the source of the effect cannot be identified and removed. (*Chapters 3 & 4)*

3. Solving current wavefront control challenges in high-contrast imaging (HCI) will boost the ultimate contrast ratio attainable by ground-based planet hunting instruments by at least an order of magnitude. (*Chapters 2, 3 & 4)*

4. In order to correctly interpret signals close to the inner-working angle of an HCI instrument, an accurate characterisation of the coronagraphic system is essential. This is readily achieved by observing extended solar system targets in parallel with optical modelling efforts. *(Chapter 5)*

5. The direct imaging instrumentation community needs to collectively spend more effort on PSF stabilisation than on designing coronagraphs capable of extremely high contrasts in a laboratory environment: without first advancing the former, achieving the latter on-sky is impossible.

6. Observational astronomers should be required to take a crash course on each instrument they use before getting access to the data, in order to gain a working knowledge of both its operating principles and individual quirks.

7. Solely publishing new results as proceedings articles hidden behind a large paywall negates the short-term accessibility advantages granted by the format: open access and peer review are both essential parts of the dissemination process.

8. Pressure to publish, combined with the concept of the “minimum publishable unit”, not only lowers the quality of academic literature but can also lead to projects being extended beyond their natural end-point.

9. No instrumentation observing trip is complete without experiencing (and dealing with) at least one near-critical hardware failure.

10. As part of a wider effort to dispel the current “fake news” culture, basic critical thinking skills need to be taught as a core part of the early school curriculum.

11. Equally, “Brexit” would not currently be an issue if the general UK population shared the Dutch openness towards other cultures.

12. English-style tea with milk should never be served in glass cups, especially those without handles.

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