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Focal-plane wavefront sensors for direct exoplanet imaging: theory, simulations and on-sky demonstrations

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Propositions accompanying the thesis
**Focal-plane wavefront sensors for direct exoplanet imaging:
Theory, simulations and on-sky demonstrations**

1. Including pupil-amplitude asymmetries in the vector-Apodizing Phase Plate designs enables (high-order) focal-plane wavefront sensing.

(Chapter 2, 3 and 4)

2. Deploying the self-coherent camera with a polarized reference beam allows for a pinhole position closer to the pupil, which strongly relaxes the requirements on the instrument and improves the wavefront sensing performance.

(Chapter 5)

3. The low-wind effect can be controlled with the Fast&Furious focal-plane wavefront sensing algorithm.

(Chapter 6)

4. Generating artificial reference speckles with geometric-phase optics results in a higher astrometric and photometric precision.

(Chapter 7)

5. All AO-assisted instruments should deploy dedicated focal-plane wavefront sensors for science operations.
6. Astronomical instrumentation research groups should always try to maintain a healthy balance between rapid innovation and maturing technology to design instruments with the best performance.
7. Networks that connect early career researchers accelerate the development of these researchers and thus move the entire field forward.
8. Combining two areas of expertise results in new ideas and improved instrumentation.
9. If we ever truly want to become a spacefaring civilization, we need not only technological advancements, but also cultural advancements that are driven by astronomy.
10. With polarization comes great power, and great responsibility.
11. Talent is useless without hard work, but hard work does not guarantee success.
12. To face the challenges of the 21th century and beyond, we need to reform the European Union governance and institutions.