

## Foreword

This book reports the proceedings of the second *Journées d’Imagerie à Très Haute Dynamique et Détection d’Exoplanètes* (Days on High Contrast Imaging and Exoplanets Detection) that were held in Nice in October, 6-10, 2003 with the joint efforts of the Collège de France, the Observatoire de la Côte d’Azur, the CNRS (Centre National de la Recherche Scientifique) and the Laboratoire Universitaire d’Astrophysique de Nice which organized the meeting.

The first *Journées* led to the publication of Volume 8, 2003 EAS Publications Series: *Astronomy with High Contrast Imaging: From Planetary Systems to Active Galactic Nuclei* that collected 33 papers presented during the session of May, 13-16, 2002. It covered a very large domain of research in high contrast imaging for exoplanet detection: astrophysical science (from protoplanetary disks to AGNs), instruments and techniques (from coronagraphy to nulling), data processing. These *Journées* took place because of the need of a working session giving enough time to the participants to explain their work and understand that of their colleagues.

The second *Journées* took the form of an *École thématique du CNRS*. The courses were held in French, but the reports are in English. The present edition reports 29 courses and short presentations given at this occasion. The texts correspond to original presentations, and a few communications, too similar to those of 2002, were not reported here to avoid duplication. This makes the two books complementary.

The general theme of the school was similar to that of the former meeting, with a marked teaching objective. The courses and presentations were also more centered in optics and instrumental techniques. The main idea was to study what we could call “*exoplanetographs*”, instruments using apodisation, coronagraphy, nulling or other techniques to directly record the light of an exoplanet. Fundamental aspects of signal processing were deferred to a third edition of the school.

A very short explanation of how the reports are ordered is given here. The *Journées* of 2003 started with the delocalized lectures (delocalized means here “not in Paris”!) of the Collège de France, of Antoine Labeyrie who wrote a report on *Removal of coronagraphy residues with an adaptive hologram*. Three invited seminars follow: Olivier Guyon (*Pupil remapping techniques*), Daniel Rouan (*Ultra-nulling interferometers*), and Kjetil Dohlen (*Phase masks in astronomy*). An illustration from Daniel Rouan’s talk on the properties of Prouhet-Thué-Morse series was also selected for the cover figure of this edition.

These papers are followed by the courses and communications given during the 4 days of the school, in a slightly different order of their presentation. The first two days were on atmospheric turbulence and adaptive optics for coronagraphy, and also coronagraphic space projects. Steve Ridgway gives a general introduction to the problem (*Astronomy with high contrast imaging*). This is followed by

a presentation on Fourier and Statistical Optics: *Shaped and Apodized apertures* (Claude Aime), *The effect of a coronagraph on the statistics of adaptive optics pinned speckles* (Claude Aime and Rémi Soummer). A general introduction to the problem of atmospheric turbulence is made by Julien Borgnino. A presentation of the Concordia site with emphasis on its advantages for high contrast imaging is given by Eric Fossat. Several presentations relative to numerical simulations of Adaptive Optics and coronagraphy follow: Marcel Carillet (*AO for very high contrast imaging*), Lyu Abe and Anthony Boccaletti share two presentations on *Numerical simulations for coronagraphy*. These presentations are followed by reports on experiments: Sandrine Thomas (*SAM-the SOAR adaptive module*), Pierre Baudoz (*Cryogenic IR test of the 4QPM coronagraph*), Anthony Boccaletti (*Coronagraphy with JWST in the thermal IR*). Pierre Bourget (*Hg-Mask Coronagraph*) ends this part with a coronagraph using a mercury drop as a Lyot mask.

The next session focused on nulling interferometry and we gather here the corresponding contribution. Two complementary reports on theory and experiment of Bracewell interferometry were made by Yves Rabbia (*Theoretical aspects of Darwin*) and Marc Ollivier (*Experimental aspects of Darwin*). Olivier Absil gave a report on the ground based nulling interferometer experiment (*Effects of atmospheric turbulence on GENIE*) and Valérie Weber on MAII (*Nulling interferometric broadband*). A comparison between nulling and different classes of coronagraphs was made by Olivier Guyon (*Coronagraphy vs. nulling*).

A few prospective papers have been regrouped at the end of the book: *Interferometric remapped array nulling* (Lyu Abe), *Multiple-stage apodized Lyot coronagraph* (Claude Aime and Rémi Soummer), *Piston sensor using dispersed speckles* (Virginie Borkowski), *Principle of a coaxial achromatic interfero coronagraph* (Jean Gay), *Coronagraphic imaging on the VLT with VIDA* (Olivier Lardière), *Phase contrast apodisation* (Frantz Martinache)

The last section regroups science aspects and results on sky, using high contrast imaging: *Low mass companions searches using high dynamic range imaging* (Jean-Luc Beuzit). The last paper by Claire Moutou (*Ground-based direct imaging of exoplanets*) can be read as a prospective conclusion of the *Journées*.

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