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Astrometry and Astrophysics in the Gaia Sky

Edited by

Alejandra Recio-Blanco

Patrick de Laverny

Anthony G. A. Brown

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**ASTROMETRY AND
ASTROPHYSICS IN THE
GAIA SKY**

**PROCEEDINGS OF THE 330th SYMPOSIUM
OF THE INTERNATIONAL ASTRONOMICAL
UNION HELD IN NICE, FRANCE
APRIL 24–28, 2017**

Edited by

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Preface

Astrometry has historically been fundamental to all the fields of astronomy, driving many revolutionary scientific results. Keplers laws, deduced after analysing the observations of Tycho Brahe, are an outstanding example of this. Four centuries later, the ESA Gaia mission is astrometrically, photometrically and spectroscopically surveying the full sky since July 2014. This survey will be complete to magnitude 20 for the astrometry and photometry and to magnitude 16 for the spectroscopy (about 1 billion and 150 million sources expected, respectively). The Gaia astrometry allows stellar distance and age estimations with unprecedented accuracy, and with the complement of radial velocities, it will provide the full kinematic information of the targets. Moreover, the photometric and spectroscopic data will be used to classify objects and astrophysically characterize stars.

The International Astronomical Union Symposium 330 has been the occasion to review the first 2.5 years of the Gaia activities and to present and discuss the first scientific results derived from the first Gaia Data Release (GDR1), seven months after its delivery in September 2016. The most significant illustration of the high impact of Gaia is probably the large involvement of the international astronomical community in this symposium: 276 participants from 35 different countries were present in Nice for this one-week symposium. Already from its first data release Gaia is therefore undoubtedly changing not only our understanding of the Galaxy and its planetary and stellar components, but also our way of working.

On the one hand, the significant increase in the precision of the astrometric measurements is sharpening our view of the Milky Way, but also of the physical processes involved in the stellar and galactic evolution. This implies an enhanced synergy between different communities (astrometry, stellar and galactic physics), and a refinement of the models and simulations that are now better constrained thanks to Gaia data.

On the other hand, the increasing number of available data has a clear impact on the analysis approaches that have to be adopted by the astronomical community, imposing robust statistical treatments, opening the path to unsupervised classification techniques and generally enriching our knowledge of the detailed physics at play in the studied astronomical objects (the Milky Way, the stars, the Solar System objects...). Moreover, from the point of view of the models and simulations, the increasing number of constraints even for low probability processes or rare objects is already acting as the catalyst of a new era in our understanding of the Galaxy, its stars, and the Solar System.

In summary, the extremely important improvement in the astrometric precision and in the number of studied objects is leading to a transformation comparable to the impact of the telescope invention about four centuries ago. IAU Symposium 330 has confirmed the start of the announced Gaia revolution and the articles in this volume testify of it. We hope that you will enjoy reading them as much as we have done.

*Alejandra Recio-Blanco, Anthony Brown and Timo Prusti, co-chairs SOC,
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Nice, July 2017*

CONFERENCE PHOTOGRAPH



Dedication of the Symposium



Photo 1. François Mignard, expert in astrometry and reference frames, and former chair of the Gaia Data Processing and Analysis Consortium, to whom this symposium is dedicated

The organizers wish to dedicate the IAU Symposium 330 to François Mignard for his outstanding contribution to the Gaia mission. François Mignard is an expert in astrometry and reference frames, and was the chair of the Gaia Data Processing and Analysis Consortium (DPAC) since its formation until the end of 2012.

François Mignard graduated in Physics from the Ecole Normale Supérieure in 1974 and he moved to Nice at the newly created CERGA (*Centre d'études et recherches géodynamiques et astronomiques*) in Grasse. His doctoral thesis, under the supervision of Jean Kovalevsky, was dedicated to the study of tidal phenomena in the evolution of planet-satellite systems. After a one year post-doc in Cornell University with J.A. Burns and one year professorship in Marseille, he returned to CERGA. During that period, he worked on radiation pressure and dust particle dynamics, on grain dynamics in rings, the rotation of Hyperion, the dynamics of Oort cloud bodies and of binary asteroids, among many other subjects. In addition, one of his constant interests was General Relativity for which the advent of space astrometry opened the way to new practical applications.

Since 1985, he became a major member of the FAST Consortium in charge of the Hipparcos data reduction. In particular, François worked on the precision and the accuracy of the Hipparcos photometric catalogue and the light-curves of variable stars, showing their powerful scientific value.

In 1991, he became member of the Hipparcos Science Team and replaced Jean Kovalevsky as the the FAST Consortium coordinator. In addition, he became responsible for a working group of the Hipparcos Science Team in charge of constructing the final catalogue of double stars.

From 1993, the concept of what later will be called Gaia was presented. Since then, François was advocating it and working on its feasibility and the expected science. In 1997, a first draft of a scientific proposal was presented to ESA and François Mignard

was member of the Scientific Advisory group created after this. Finally, as a recognition of his major role in the preparation of the data treatment, he became chair of the Gaia DPAC in 2006. He tirelessly worked on DPAC activities since then, even after stepping down as DPAC head at the end of 2012.

In addition to his international responsibilities, François had many local and national management activities. In particular, he was director of the CERGA laboratory from 1993 to 2004, principle investigator for the French *Action Spécifique* Gaia, and founder of the Gaia group at the Observatoire de la Côte d'Azur. Thanks to his national and local investments, a long list of researchers and engineers got permanent positions in France to work on Gaia science. In Nice, a whole new Gaia generation emerged thanks to him.

If, as François says, science is a learned mixture of *savoir faire* and *savoir dire*, François himself is an outstanding example of it. But, more than that, he is a universalist capable to explain to you during an informal conversation the dates of the swift migrations, the physical details of the Corsica island vision from Nice, the different types of spiders, the exact antipodes of your birth place, the trips of the ancient explorers of the world, the rugby matches of the French national team, etc... People like us, having the wonderful opportunity to work with him, can testify that François is not only a remarkable scientist, but also a remarkable human being.

On behalf of the SOC and the LOC, Alejandra Recio-Blanco, Anthony Brown, Timo Prusti and Patrick de Laverny

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