

POST-HIPPARCOS COSMIC CANDLES

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POST-HIPPARCOS COSMIC CANDLES

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FOREWORD

In May 1976, when one of us was temporarily associated with Strasbourg Observatory for lecturing on distance determination methods (Heck 1978), Pierre Lacroute – then in his last year as Director there – modestly requested comments on a project he had been cherishing for quite a few years, and which he had been presenting to visitors and colleagues: an astrometric satellite.

His persuasiveness and persistence won support from the scientific community, from the French space agency CNES and from the European Space Agency (ESA): the Hipparcos satellite was born. It was fitting that Lacroute lived long enough after his retirement to attend the launch of his brainchild in 1989 and to see it successfully operational. He knew however he would not enjoy the completion of this long and ambitious mission (he passed away on 14 January 1993, a few days before reaching the age of 87).

In May 1997, in the prestigious setting of San Giorgio Maggiore in Venice, ESA organized a symposium celebrating the presentation of the Hipparcos and Tycho catalogues. That conference signalled also the release of the first scientific results based at least partially on Hipparcos data. An impressive proceedings volume (Battrick 1997) of more than nine hundred pages, gathering together almost two hundred contributions, gave evidence of numerous studies in progress, in addition to papers starting to appear in the classical journals. The well-maintained ESA Hipparcos web site (<http://astro.estec.esa.nl/Hipparcos/>) also deserves regular visits as it testifies to the dynamism of the space astrometric community at large, spanning now practically three generations of astronomers.

For all the excitement that can result from investigating new data, lessons from the past should not be forgotten. Thus, at the *Hipparcos Venice'97* symposium, it was striking that quite a few discussions on RR Lyrae stars were the same, almost word for word, as those heard twenty-five years ago. Methodological aspects should also be carefully appreciated. Experience shows (Jones *et al.* 1980; Heck & Fernley 1998) that alleged improvements of newly developed algorithms are often not adequately tested

against older methodologies. Also not infrequently, carefully explained error bars have to be requested from authors who are a little too *enthusiastic* in offering differing results.

On the other hand, extensive grids of nonlinear, nonlocal and time-dependent convective RR Lyrae models have recently allowed a sound theoretical scenario for the analysis of these variable stars as observed in globular clusters and galactic fields (Bono *et al.* 1997a,b,c). Moreover, the numerous updatings of stellar models have led to continuously revised calibrations of the most relevant evolutionary parameters, actually removing an unpleasant *conflict* between the age of globular clusters and the expansion age of the universe (Caputo 1998 and references therein).

The production of the present volume was thus quite timely and it has been a real pleasure and a great honour to be given the opportunity of compiling it.

After discussing Hipparcos' contribution itself, the book starts with chapters concerning the *primary* distance indicators to young (Classical Cepheids) and old stellar populations (RR Lyrae stars). These two classes of pulsating variable stars are traditionally used as reliable *standard candles* since it has been known for many years that their absolute magnitude is a function of period (Cepheids) or metallicity (RR Lyrae stars). However, the reader will soon realize that a number of problems arise when allowing for the calibration of the period-luminosity relation for Cepheids (it is "universal?", i.e., "are the slope and zero-point independent of metallicity?") as well as of the metallicity-luminosity relation for RR Lyrae stars (it is "universal?", i.e., "is there any significant difference between field and globular cluster populations?"). The contribution of Hipparcos data, not only for the above variable stars but also for Miras, subdwarfs, etc., is discussed in the volume through a comprehensive state of the art review of the numerous studies on this topic, including the distance scale to globular clusters, which is a fundamental requirement for estimating their ages and, in turn, for setting a lower limit to the age of the universe.

After a first "jump" out of the Milky Way through present knowledge of the distance to the Large Magellanic Cloud, we move to extragalactic distance determinations with a group of chapters where several *secondary* distance indicators are discussed, sometimes closing with the estimate of the Hubble constant.

Last, but far from being least, the rôle of the microlensing surveys is presented, with their extraordinary potential in providing thousands and thousands of distance indicators in the nearby galaxies. At the very end, the up-to-date results of stellar evolution theory are discussed, but together with a frank admission of their limits!

Certainly there were several possible sequences for presenting the vari-

ous contributions of this compendium. However, the quality of the authors, the scope of experience they cover, the messages they convey, – all make of this book a unique publication, superseding the relevance of sequencing. The reader will certainly enjoy as much as we did going through such a variety of well-inspired chapters from so many different horizons.

It is also a very pleasant duty to pay tribute here to the various people at *Kluwer Academic Publishers* who quickly understood the interest of such a volume and enthusiastically agreed to produce it.

The Editors,
July 1998.

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