WELCOME ADDRESS

Friends, colleagues, I would like to welcome you all to this workshop 'Future Prospects for Astrometry in Space', organized jointly by the Royal Greenwich Observatory and the European Space Agency.

The Royal Greenwich Observatory has a long and rich tradition in astrometry: its original aim was to provide means for accurate navigation at sea from positions of the moon, planets and stars. The Greenwich Meridian and Greenwich Mean Time are global reference features reminding us of the work of the early days of the Observatory. Its involvement in astrometry in recent years has also been at the forefront of science. The Carlsberg Automatic Transit Circle has been for years the leading instrument in its field, and we are all aware and familiar with the involvement of the Observatory in the ESA Hipparcos space project.

The European Space Agency made this unexpected and daring step of taking astrometric measurements off the ground into space in the early 1980s. This was an entirely new field of space exploration, one that to some may not have appeared very spectacular. New techniques were implemented that allowed determinations of absolute parallaxes, something not possible from the ground. We now know that, after 3.5 years of data collecting and reductions at various institutes in Europe, the mission has been a great success, achieving its original aims despite irreversible problems with its orbit. We are now all looking forward to using the data after its publication at the beginning of 1997.

The Hipparcos project has shown that it is possible, and very efficient, to make high-accuracy astrometric measurements from space. Astrometric data provide the foundations of astronomy: nearly every astronomical measurement ultimately is calibrated using data obtained through astrometry. The great improvement made in this field by the Hipparcos measurements will be evident from the study of the Solar System, and on theories of stellar evolution and structure, on studies of stellar dynamics, and ultimately on cosmology. So, one may ask, what is the need for another mission, obtaining even greater accuracy and measuring many more stars?

In fact, good as it has been, the Hipparcos mission was very limited: the faintest stars observed are around 12th magnitude, with completeness at 8th magnitude. Accuracies obtained for parallaxes are at around 1 mas. With these limitations, only a small volume (100 to 200 pc radius) around the Sun can be studied with any useful accuracy. No accurate distances of Cepheid, RR Lyrae or main sequence O stars are obtained. Such stars, used for extragalactic distance calibrations, are still out of reach of the Hipparcos astrometric measurements.

Building on the experience now available at ESA and at the European institutes that have been involved in the Hipparcos project, it now seems the right time to start thinking about a follow-up project, one that would reach much further into the Galaxy. A concept for such a mission has now been designed, called GAIA. Using interferometric techniques, astrometric accuracies become possible that are very hard to imagine. It has been said that the accuracy with which Hipparcos measured parallaxes was equivalent to the size of a person standing on the Moon as seen from the Earth. With GAIA, reaching 10 microarcsec accuracy, we would be measuring the size of the buttons on the shirt of that person! Perhaps even more vivid for me is that this accuracy

is represented by the angular diameter of a human hair at 2000 km! It would be possible to see a displacement the size of the Earth's diameter at 8.7 pc, and the size of the Sun's diameter at nearly 1 kpc. This will open up our Galaxy astrometrically: tens of millions of stars within 5 to 10 kpc will yield accurate distance determinations, opening the way for detailed calibrations of stellar luminosities with age, abundance variations, rotation and variability. The possibility of investigating some 100 000 stars for the presence of Jupiter-like companions, and a few hundred of the nearest stars for much lower-mass companions, is only one of the many exciting prospects for a future space astrometry mission.

The GAIA concept, proposed for the Horizon 2000+ programme as a cornerstone project, clearly represents a major technological challenge. This workshop will be one of the first steps on the way to defining the needs and possibilities of such a future astrometric space mission. It brings together scientists and technologists from all over the world. I hope you have a successful workshop and an enjoyable stay in Cambridge.

Alec Boksenberg

Director of the Royal Observatories