FOREWORD

Astronomy is the most ancient science humans have practiced on Earth. It is a science of extremes and of large numbers: extremes of time – from the big bang to infinity –, of distances, of temperatures, of density and masses, of magnetic field, etc. It is a science which is highly visible, not only because stars and planets are accessible in the sky to the multitude, but also because the telescopes themselves are easily distinguishable, usually on top of scenic mountains, and also because their cost usually represent a substantial proportion of the nation's budget and of the tax payers contributions to that budget. As such, astronomy cannot pass unnoticed. It touches on the origins of matter, of the Universe where we live, on life and on our destiny. It touches on philosophy as well as on religion. Astronomy is the direct contact of humankind with its origins and the immensity of universal nature. It is indeed a science of observation where experimentation is practically impossible and which is ruled by mathematics, physics, chemistry, statistical analysis and modelling, while offering the largest number of verifications of the most advanced theories of fundamental physics such as general relativity and gravitation. At the beginning of the 21^{st} century astronomy is clearly a multidisciplinary activity touching on all aspects of science. It is therefore logical that in the past and still now, astronomy has attracted the most famous scientists, be they pure observers, mathematicians, physicists, biologists, experimentalists, and even politicians.

It is open to the non scientists: amateurs can practice astronomy and they do abound all around the world, sometimes contributing to discoveries like in the case of comets. The images of galaxies and of planets do possess an undisputable beauty and, naturally, astronomy is a subject of interest and most often of excitation to the public. It is one of the most popular branches of science. The drawback, unfortunately, is that it has a tendency of sometimes lying at the limit of scientific rigor. However, the rigorous scientific character of astronomy as well as its popularity re-enforces the need for a broad distribution of scientific results and discoveries in the peer-reviewed journals as well as in more popular magazines and reviews.

As old as it is, astronomy looks remarkably young. This is because in the past 50 years, it has witnessed a genuine revolution. Revolution in the techniques and technologies of observation, which started with the development of larger and bigger telescopes, of radio-astronomy and, since the beginning of the space age, of observatories operating above the Earth's atmosphere, accessing the full range of the electromagnetic spectrum, free of turbulence image-deterioration effects, revealing phenomena which had no or very little observational signatures in visible light from ground-based observations. Astronomy, together with nuclear physics and space science, is part of the so-called big sciences. In the course of the last 25 years, the revolution has accelerated with the development of even larger telescopes in the 10 meters class, like the Very Large Telescope under the responsibility of ESO, of interferometry like the VLA, IRAM, and ALMA. The advent of the Charge Coupled Devices (CCD), replacing the old photographic plate, together with the informatics revolution, have led to the development of a more precise numerical astronomy and to the establishment of data bases remotely accessible and at the same time, to the concept of virtual observatories.

Because stars and galaxies are by essence accessible to everybody on this planet – those who are rich and technologically advanced, as well as the poorer but nonetheless open-minded populations, curious and avid of knowledge as they are –, astronomy is (as it has always been) an activity of intrinsic international character. This character is amplified today by the need of sharing among nations or groups of nations the big facilities which demand resources very often far too expensive for individual countries resources.

On the other hand, this revolution bears in itself potentially and somewhat concerning adverse effects. The size of instruments require the support of big organizations, rely more and more on big industries and less on small groups of experimenters and of laboratory physicists. For the new generation of students, the tendency to avoid risks in the running of their research in view of getting diplomas and PhDs in the shortest possible time, leads to the development of a new class of astronomers which we could qualify as "arm chairs-CRT astronomers", spending their time more and more on computers and less and less in the development of observational techniques or even hardware. Getting one's hands dirty in astronomy is less and less easy these days. We witness a tendency for some kind of autism among the young generation being less sociologically active and more remote from the reality of the needs and of the tools and of the mechanisms that support their research.

These general – and somewhat trivial comments – outline the more pressing need to describe not only to the scientists themselves but also to

the public at large, the complexity of the network of tools that make modern astronomy one of the most essential branches of science and a vector of knowledge that permanently pushes the limits of our curiosity and of our ignorance. This last volume of the *Organizations and Strategies in Astronomy* books is to be seen as a crowning piece of the previous descriptions contained in the past volumes of the series of these complex mechanisms.

Readers will get closely in touch with the management of big programs. They will learn how international organizations operate and how individual nations, both the most advanced and the less advanced can develop their own means as well as sharing their resources in common with others in the development of big facilities. They will acquire the notion of this international character also through the networking of data bases of astronomical objects, of observational data, of scientific articles and of the bibliography of the actors of astronomy, those who contributed to the most advanced discoveries and those who devoted their life and careers to the development of new techniques.

Readers will perceive the concerns that confront astronomy in the modern age of space and the growing severity of competition to access these big facilities, and how the supporting international organizations respond to the needs of the scientists worldwide. They will perceive the tremendous power of astronomy for education and for responding to the most profound philosophical questions confronting humanity since the birth of its cognitive capacity. At the same time, they will be in close contact with the needs for scientific rigor as well as with the responsibility for astronomers to transmit their acquired knowledge to those who through their daily work and their taxes make the development of these facilities and of this research possible. They will be confronted to the fundamental need of scientists and of astronomers for free thinking, for preserving their capacity and their responsibility in resisting political or anti-scientific arguments.

The leading master of this series, André Heck, should be warmly congratulated for having taken the initiative of this series and having led this set of useful tools. There is a need for pursuing this activity in the future given the rapid status of evolution of astronomy as the new century promises to be one of even more numerous and extraordinary discoveries, as the tools described in the OSA books become operational and deliver their promises.

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