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THE ASTRONOMICAL OBSERVATORY OF BUCHAREST HAS 90 YEARS

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Abstract. The two thousand years old evolution of the astronomy on the Romanian territory led in 1908 to the foundation of the Astronomical Observatory of Bucharest. Its beginnings, its development, as well as its regress during the period 1975-1990 are being shown. The new advances experienced after 1990 within the framework of the Astronomical Institute of the Romanian Academy are also presented. One ends by pointing out the present activity of the Institute, and some perspectives as well.

Maybe no science experienced such a spectacular evolution as the astronomy during this century. New theories, new discoveries changed fundamentally the vision we have had about the Universe few decades ago. Of course, essential contributions to this development are due to the great observatories, and to the frequent space missions, as well. But the contribution all the other observatories (spread all around the world and especially in Europe) have brought and still bring to the remarkable advance of astronomy must not be forgotten.

One of these observatories is situated since the dawn of this century in the South-Eastern zone of the old continent, in the middle of the Northern hemisphere. This is the Astronomical Observatory of Bucharest, the Capital of Romania, observatory which has turned 90 years on 1st of April 1998.

The existence of Romanian astronomical traditions, the advances of the astronomy along the second half of the 19th century, as well as the necessity of increasing the number of observation centres throughout the world led to the set up of this observatory.

When we speak about the Romanian astronomical traditions, we may go as far back as the beginning of the first millenium. Two thousand years ago, the Dacians - inhabitants of this land and, together with the Romans, ancestors of the Romanian people - raised a sanctuary in the Meridional Carpathians, at Grădiştea Muncelului, a sanctuary which still keep firm evidences of their astronomical knowledge.

Later, in early 6th century, the Christian Church tried to impose a more suitable chronological system. The author of this chronology was Dionysius Exiguus, a monk born in the Romanian parts, in Dobrogea. In AD 528, in his *Liber di Paschal*, he proposed the counting of years starting from Jesus Christ's birth.

Although the astronomy can be considered one of the oldest sciences, its really scientific substantiation dates only from the 16th and the 17th centuries. Concerns in astronomy can be recovered also in Romania during that period, and even before. We shall mention, for instance, the first astronomical observations performed in this part of Europe by the bishop Ioan Vitez (1408-1462). The observatory of Oradea was set up by him in 1445, before that raised by Tycho Brahe at Uraniborg.

A century later, Johannes Grass (Honterus) published *Rudimenta Cosmographica* (1548), which contained many elements of astronomy. The book had a great echo in that epoch, and saw 26 successive editions which have been used for a long time in Germany as textbooks of astronomy.

We can also mention the *Colligate* of Sibiu, in which Conrad Haas (1509-1579) described the stage rockets (and used this denomination) for the first time.

The 16th and the 17th centuries represented an important epoch from the standpoint of spreading the astronomical knowledge in the more and more numerous colleges founded in the three Romanian countries: Transylvania, Moldavia, and Wallachia.

Among the scholars of that period, we shall mention only the name of Hrisant Notara (Chrisandos Notaras), former disciple of G. D. Cassini at the Observatory of Paris. He left us the *Introduction ad geographiam et sphaeram* (Paris, 1716), the first Romanian scientific work which contained chapters dedicated to astronomy.

The 19th century brought deep changes in the whole Europe, implicitly in the Romanian countries. In 1859, Moldavia and Wallachia merged into the first modern Romanian state. This imposed reforms, not only in the political and social life, but also in education, this one being eventually oriented towards the western culture.

As Paris was the most important cultural centre of Europe in which astronomy was practised, the first students longing to learn the science of heaven were sent in the Capital of France. It is not interestless to recall that out of the first four Romanian doctoral theses (in mathematics) defended at Sorbonne, three dealt with celestial mechanics. We refer to: Spiru Haret's thesis (1878) on the stability of the major axes of planetary orbits, Constantin Gogu's thesis (1882) on the long-periodic inequality of the Moon's motion, and Nicolae Coculescu's thesis (1895) on the motion in a particular case of the three-body problem.

(By the way, also in Paris, but at the Observatory, directed then by Le Verrier, another young Romanian has been studying: Constantin Căpităneanu, the author of the first Romanian work of astronomical observations, *Determination of the Differences of Longitude between Jassy and Chernowitz.*)

All three above mentioned theses were eulogized by the renowned French scientists. For instance, Poincaré appreciated Haret's conclusions as a big surprise. The same Poincaré quoted Coculescu's results in his famous book *Leçons de mécanique céleste.* Gogu's researches proved their validity many decades later, when they were quoted in the theoretical works intended to prepare the lunar space missions. Moreover, when the international astronomical community named the formations discovered on the Moon's invisible face, the name of Spiru Haret was assigned to a crater.

Such well-appreciated results represented scarcely the start of researches to be continued in Romania. But in this country there was not a nucleus of astronomical

research yet. The necessity of such a centre had been emphasized as far back as in 1870, when P. S. Aurelian, a remarkable political figure and a man of great culture, asked the government and the legislative body: how long Romania will still be deprived of such an important research institution, already existing in countries with much lower incomes? Another man of culture, well-known by the international scientific community of that time, Ştefan C. Hepites, applied repeatedly to the authorities, especially to the recently founded Academy, soliciting the set up of an astronomical institution. As a director of the Meteorological Observatory, he knew better than anyone else how necessary was the foundation of certain special services for: keeping the precise time, determining the geographical coordinates by astronomical methods, observing remarkable celestial phenomena, etc. To be more convincing, he elaborated a first historical sketch of the evolution of the Romanian astronomical knowledge, in order to prove that concerns in astronomy were familiar to our people, and a tradition in this field was already existing. Of course, both his scientific grounding and the epoch's custom determined him to ask for the set up of an astronomical observatory within the framework of the meteorological one.

The Board of Agriculture had purchased as far back as in 1888, for the Meteorological Institute and the Centre for Measures and Weights, an estate of Constantin Bozianu, ex-counsellor of the first Prince of the Romanian Countries, Alexandru Ioan Cuza (1859-1866). This ground was lying on the Filaret Hill, in Bucharest, at only three kilometers from the centre of the town. Here was raised, after four years only, the first stable building intended to astronomical observations: a small meridian hall of 16 m^2, which had to be endowed with a transit instrument of 1 m focal distance and 67 mm diameter of objective, installed on a pilaster whose basis was at 3.25 m under ground.

Finally,as a result of the insistences of Ştefan C. Hepites and Nicolae Coculescu, one decided the set up of the Meteorological and Astronomical Observatory. The foundation decree is dated 1st of April 1908 and is signed by the Minister of Worship and Education, Spiru Haret. Nicolae Coculescu was appointed as the first director of the Observatory.

The astronomy separated from meteorology only in 1920.

So, 90 years ago, it was created the first Romanian modern institution intended to study the Universe.

During the same year, another astronomical observatory, this time a private one, was founded in Basarabia, on the right-hand bank of the Nistru river, at Dubosarii Vechi. It was directed along 32 years by Nicolae Donici, one of the most interesting personalities of the Romanian and world astronomy. Born in 1884 in Basarabia, he worked until 1917 at the Imperial Academy in St. Petersburg. The stormy events which took place in February 1917 determined Donici to leave Russia for Odessa. But the communists reached Odessa, too, and Donici left his instruments, fixing his residence at his observatory, in Basarabia, recently retroceded to Romania. This situation had to last only until 1940, when the Soviet Union seized again Basarabia. Donici moved to Bucharest, but in 1944, when the communist danger had become impending, he left forever his native country for France, where he had to work at the

Observatory of Paris. Although founding member of the International Astronomical Union, active participant in the first six General Assemblies of this one, author of important works in astrophysics, observer of no less than six total solar eclipses, however the last years of his life constitute a genuine mystery. There are no documents recording the date and the place of his death.

The Observatories of Bucharest and Dubosarii Vechi were followed soon by two other observatories: that of Jassy (1913), directed by Constantin Popovici, and that of Cluj (1921), directed by Gheorghe Bratu. The observatory of Timişoara was built much later, in 1959, due to the endeavours of Ioan Curea.

The Observatory of Bucharest was and remained the most important observational centre, due especially to its initial endowments. Nicolae Coculescu did his best to purchase the most modern instruments of that time: the great meridian circle Gauthier-Prin (190/2350 mm) and the double astrograph Gauthier-Merz (380/6000 mm). Due to both their remarkable optical qualities and the care with which Gheorghe Demetrescu set them up, they still are considered among the performant instruments of this type.

Later on, other devices joined them: a Zeiss transit instrument (100/1000 mm), used from 1956 up to 1990 to the study of the irregularities of the Earth's rotation; a Cassegrain reflector (50/500/7000 mm), installed in a 5 m diameter dome; a Zeiss equatorial refractor (130/1950 mm), to which it was added a smaller refractor (100/1500 mm), endowed with an H_α filter, for solar observations; an AFU-75 photographic camera for artificial satellite observations; a Danjon astrolabe (100/3500 mm) recently transferred from Brussels; an hour service, endowed first with Belin quartz clocks, then with Rhode & Schwartz clocks, later with Romanian hydrogen masers, and very recently with a GPS time receiver; a modern computing base (a superscalar computer Silicon Graphics Power Challenge M, and a graphical workstation INDY connected to PCs).

The instruments worked in parallel with those of Cluj: the Newton reflector (508/2500 mm), the Prin refractor (203/3000 cm), the UFISZ-25-2 photographic camera for artificial satellite observations, and the recently purchased Schmidt-Cassegrain reflector Meade (400/4064 mm), and those of Timiş oara: the Cassegrain reflector (300/1690 mm). Most instruments have been modernized, especially by endowing them with CCD cameras.

During the inter-war period, the staff of the Observatory of Bucharest was extremely scanty. The very few astronomers performed both research and teaching. Nevertheless, some succeeded in becoming remarkable professors and, at the same time, researchers well appreciated by the international astronomical community. Out of them we mention: Constantin Popovici (1878-1956), Gheorghe Demetrescu (1885-1969), Constantin Pârvulescu (1890-1945), Nicolae Dinulescu (1906-1989), Constantin Drâmbă (1907-1997), Ella Marcus (1909-1982), Călin Popovici (1910-1977). Three of them also were directors of the Observatory: Constantin Popovici (1937-1943), Gheorghe Demetrescu (1943-1963), and Constantin Drâmbă (1963-1977).

In 1951, the Astronomical Observatory became an institution of the Romanian Academy. But, during the period 1975-1990, the Academy lost its research units, so

that the Observatory was patronized by different institutions. In 1990 the Academy regained its fundamental research institutions; among them - the Observatory of Bucharest (on 1st of April 1990), this time within the framework of the Astronomical Institute.

After 22 December 1989, Romania experienced a new stage in its evolution, which was felt in the astronomical research, too.

To understand what the present stage of development means for the Romanian astronomical research, we have to recall some essential aspects. The last decades, especially the eighties, meant a total isolation from the scientific world, both western and eastern. The Romanian astronomers did not attend international scientific reunions; any cooperation with other observatories was stopped; the reference material was missing; the astronomical journal had been suppressed. Moreover, in the eighties one of the main purposes was the economic efficiency. This constituted always a hard problem to face for any fundamental science, astronomy included. So, the astronomers had to sacrifice many time and many energy to work under "economic" contracts which hardly allowed them to earn the living.

Given this situation, the return of the astronomical research to the Academy, as well as the reunion of the three main observatories (Bucharest, Cluj, and Timişoara) into a single institution, the *Astronomical Institute of the Romanian Academy*, meant a new orientation for the development of astronomy in this part of Europe.

The main topics approached during the present decade are: physics and evolution of stars, solar physics, celestial mechanics, dynamics of the solar system bodies, artificial satellite dynamics, cosmology, history of astronomy.

The most significant results are presented at the scientific sessions organized yearly by the Institute, as well as at various national and international reunions. At the same time, they are published in journals all over the world, or in the *Romanian Astronomical Journal*, which resumed since 1991 the former *Studii şi Cercetări de Astronomie* (suppressed in 1974). Other publications of the Institute are *Anuarul Astronomic*, *Observations solaires*, and *Annual Report*. The latter two ones are recently disseminated via Internet, too.

To fill as soon as possible the gaps appeared in the research of the last decades, we considered that one of the best ways is the specialization of the young researchers in the most famous academic centres. Ten young astronomers (namely about a quarter of the research staff) are preparing or have already defended their Ph.D. theses at universities as Yale, Bonn, or Heidelberg, or at observatories as those of Paris and Brussels.

The Institute cooperates officially with the Observatories of Athens, Belgrade, Brussels, Budapest, Moscow, Paris, Prague, Sofia, and Warsaw. Subsequently, there were organized or are in preparation reunions: the International Colloquium *PHESAT '95* (Bucharest, September 1994), the NATO Advanced Research Workshop *Theoretical and Observational Problems Related to Solar Eclipses* (Sinaia, June 1996), four Yugoslav-Romanian Astronomical Meetings (Timişoara, 1995; Belgrade, 1996; Cluj, 1997; Belgrade, 1998), two Romanian-Russian round tables (Bucharest, 1997; Moscow, 1998), two International Workshops on Celestial Mechanics and Space Dynamics (Cluj, 1997 amd 1998).

An exceptional astronomical event imposes a new pace of work to the Romanian astronomers: the total solar eclipse of 11 August 1999, whose maximum will be in Romania.

Here will be: the maximum duration of the eclipse (2^{min} 23^{s}), the maximum coverage of the Sun (103 %), the Sun's maximum height (59°), the maximum altitude for observing sites (more than 2500 m in the Meridional Carpathians). Moreover, Bucharest is the only capital city situated in the totality band, namely exactly on the centrality line. The Astronomical Institute has two observatories (Bucharest and Timişoara), the only in the world, able to observe the eclipse by means of stable instruments.

To use them in the most favourable conditions, the Institute, together with the Working Group "Eclipses" of the IAU, initiated a contest for the best programmes intended to observe the eclipse with stable instruments.

There will also be organized two summer schools for the young people that want to profit by this outstanding event in order to learn as much as possible from the specialists who will come in Bucharest to observe the eclipse. We refer to a NATO Advanced Study Institute meant to Ph.D. students and young researchers, and to an International School for Young Astronomers, under the aegis of the IAU, which has in view especially students from countries where the astronomy is still in an early stage of development.

Among other scientific sessions to be held in Romania in August 1999, we mention: the General Assembly of the International Union of the Amateur Astronomers, the Reunion of the Astronauts, the third edition of the World Conference on Salt.

All these international reunions, as well as the continuously growing interest proved by mass media and the public (in 1997 the Institute initiated, for the first time in Romania, "The Open Day"), require an increasing effort from the researchers. Yet more, they want to profit at the most by this event in order to ensure a convenient level of development to the astronomy in this part of Europe. In this context, our projects include an observation station situated at 100 km north of Bucharest, and an extension of the main building of the Observatory of Bucharest for a public Planetarium.

Of course, the amazing performances of the space techniques will change very soon the "image" of an astronomical observatory, that of the Bucharest one included. As the other ground-based observatories, our Observatory will receive the continuously increasing quantity of data transmitted from space, in order to process and interpret them. However, as it was pointed out recently at an international workshop (*Journées '97*) organized in Prague by the Czech, French, and Romanian astronomers, the ground-based observations still have a role to play. This is the reason for which we think that the centenary of the Observatory of Bucharest will find this institution in full activity, and its researchers will continue to contribute to the knowledge of the Universe at the dawn of the new millenium.