Publ. Astron. Obs. Belgrade No. 85 (2008), 169 - 180 *Invited lecture*

THE NATIONAL ASTRONOMICAL OBSERVATORY "ROZHEN" – A CENTRE FOR ASTROPHYSICAL INVESTIGATIONS IN BULGARIA

DIMITER KOLEV

Institute of Astronomy, Bulgarian Academy of Sciences
NAO "Rozhen", P.O.Box 136, 4700 Smolyan, Bulgaria
E–mail: dzkolev@abv.bg

Abstract. The Bulgarian National Astronomical Observatory (NAO) located close to the Rozhen ridge in the Rhodope Mountains near Smolyan, is presented with its history, functional characteristics and capabilities. Its latitude of $41^\circ\ 41.5'$N gives opportunities to investigate over 80% of the celestial sphere. The altitude of 1750 m lies within the height level that is most populated by observatories (1500-2500m). However, the astroclimate (mean seeing ∼2" and 35-40% clear sky time) is worse than that of the best world sites and corresponds to the mean for the continental Southern Europe. The light pollution near NAO is still the lowest among the Balkan sites, but some problems arise because of the ever growing illumination from the Pamporovo resort and the nearby towns of Smolyan and Chepelare.

Equipped with 2-m, 70- and 60-cm stellar and 15-cm solar coronograph telescopes, NAO allows observations to be made for a wide range of optical astrophysical investigations: from Solar System bodies to extragalactic sources. The productivity of the 2-m telescope is quite comparable with that of other telescopes of similar class. Important studies (photometric, spectral, morphologic) of stellar clusters, flare stars, variable stars, nearby and distant galaxies were performed with/at the NAO telescopes. The 2-m telescope is very suitable for spectroscopic investigation with moderate resolution and it can be a subject of its future specialization in the era of giant telescopes of decameter size.

The future of NAO can be connected with educational and conference activities if Bulgaria joins ESO – the most desirable way to develop astronomy in our land/in our country.

1. INTRODUCTION

Twenty-six years ago, on March 13, 1981, the Bulgarian National Astronomical Observatory "Rozhen" (NAO) was officially opened – Fig. 1. This was the final result/product in the long sequence of dreams, ideas, projects, decisions and actions of many people and institutions which placed Bulgaria among the modern nations *possessing their own resources* to investigate the Cosmos.

The professional astronomy in Bulgaria is less than 150 years old. The Bulgarian encyclopedist Dr. Petar Berovich (Beron) wrote the first astronomical texts in the late 60-es of the 19^{th} century. The first Bulgarian observatory is that of the Sofia University that was set up in 1894 by Prof. Marin Bachevarov. Originally equipped

Figure 1: The 2-m telescope dome and the laboratory building in NAO (left) and the domes of the three smaller telescopes (right).

with Dr. Beron's personal small refractor "*Merz*", the observatory obtained a modern 16-cm refractor "*Grubb*" in 1897 and another 11-cm refractor in 1913. Until the mid-1960's these were the only serious astronomical instruments in Bulgaria. In the 40-es and 50-es Prof. Nikola Bonev developed plans for a relatively large university-class observatory with 1-m reflector, but these dreams remained unrealized. Evidently, the astronomical researches were not among the priorities of the Bulgarian science and authorities.

The situation changed dramatically in the late 50-es when the first man-made Earth satellite was launched. The great public interest resulted in the establishing of a dozen Public Astronomical Observatories across Bulgaria (Stara Zagora, Varna, Smolyan, Yambol, Gabrovo, Dimitrovgrad, etc.) some of them equipped with planetariums (Stara Zagora, Varna, Smolyan, Yambol). A broad net for optical observations of satellites was organized in these centres of astronomical education and skills. Since 1965 the main telescope of Bulgaria was the 60-cm Zeiss reflector in the Belogradchik Public Observatory (650 m above sea level), which soon became part of the Bulgarian Academy of Sciences (BAS).

Meanwhile, in the established in 1952 Department of Astronomy in BAS, Prof. N. Bonev continued to lobby for an even larger telescope in Bulgaria. The dream started coming true after the Bulgarian Council of Ministers issued its Decision Nr. 203/06.05.1967 to build a National Astronomical Observatory with 1-m reflector under the care of BAS. Simultaneously, the local government of Smolyan district decided to build another 1-m telescope in the Rhodope Mountains. Finally, the two projects were unified, the Rozhen area near Smolyan was chosen for NAO and in 1970 a contract for a 2-m telescope of Ritchey-Chretien design was signed with Carl Zeiss, Jena in the former DDR. The observatory was officially opened during the celebration of the 1300th anniversary of the Bulgarian State in 1981, but the 2-m RCC telescope has been in regular use since the end of 1980.

2. NAO "ROZHEN" AS ASTRONOMICAL FACILITY

Astronomy is observational and "expensive" science because of its instrumentation – the big telescopes and their auxiliaries. It costs millions and even billions both as machinery (being a combination of high-tonnage moving masses with requirements for optical, sub-micron accuracy of the details) and as infrastructure (the observing complexes are placed in hardly accessible mountain sites). The progress in the mechanics, optics and electronics during the 20^{th} century has led to an exponential increase of the total collecting area of the professional astronomical telescopes – from ~ 10 m^2 at the beginning to $\sim$1500 m^2 at the end of the century). This increase continues today with the mega-projects for astronomical apertures of decameters (30-50 m)! Simple calculations show that all the telescopes of the last century have collected a total of only *few milliwatt-hours* (i.e., *a few calories*) energy from the celestial sources. This miserable amount of energy lies in the basis of our knowledge about the Universe! We must not forget that only 80 years ago there was no extragalactic astronomy or physical cosmology!

In the same time this energy is surely the most "expensive" for the mankind – the total "price" of this new knowledge exceeds several billions of dollars. Only the VLT-complex costs *half a billion*; on the Mauna Kea about 10 nations have invested also about 1 *billion*, etc. *One* observing night on Kecks costs almost 50000$! In general, only 1 minute of observations now costs (in $ or) from $\sim$2-3 (for our 2-m telescope with 30-40% meteorological efficiency), through 15-20 (for a 3.5-4 m with 75% climate efficiency) to more than 60 *for every one* of the four 8-m telescopes of VLT. The *Hubble* Space Telescope (2.4-m, in operation since 1990) costs in total $\sim$2.5 *billions*! One billion will be the cost of any of the future decameters.

The total cost of NAO – 12 millions (in 1970) looks very moderate but in fact it was (and remains!) the biggest single investment in the 138-years-old Bulgarian Academy of Sciences (BAS). Initially the *Plana Mountain* near the capital Sofia was chosen as the location for the new observatory (now there is the geodetical observatory of BAS). The altitude (1200 m) and the closeness to the big city were not among the advantages of this place and the decision to move the project to the *Rhodopes* was very important.

2. 1. FUNCTIONAL CHARACTERISTICS OF NAO: SITE AND ASTRO-CLIMATE, EQUIPMENT AND PROGRAMS

Astronomy and its currently dominant field – astrophysics – are based on the *observations* of the celestial events. Hence, for one national astronomical tradition it is of ultimate importance to have resources for such investigations. NAO "Rozhen" has fulfilled exactly this need. Besides the universal 2-m RCC (Ritchey-Chretien-Coude) from "Carl Zeiis", Jena, NAO is equipped also with 3 smaller instruments: 60-cm reflector "Zeiss" suitable for photometry, 50/70-cm wide-field Schmidt-camera "Zeiss" with 4° objective prism and 15-cm self-made solar telescope- coronograph. The technical data about the telescopes are presented in Table 1 and views of the telescopes – in Figs. 2 and 3.

Figure 2: The 2-m telescope at NAO: the optics (up left); a two- channel focal reducer (down left); the CCD-camera "Roper", 1x1K, 24 μ pxl (up right) and the coude-spectrograph (down right).

Figure 3: 50/70-cm Schmidt (left), 15-cm solar coronograph (centre) and 60-cm reflector (right).

Equipped with such technology NAO "Rozhen" completely corresponds to the "classic" model of a 20^{th} century optical observatory: big universal "stellar" telescope, smaller wide-field camera, second "stellar" photometric telescope and a solar telescope. We find a similar structure in many well known world observatories: Palomar, Byurakan (Armenia), Anglo-Australian Telescope in Siding Spring, etc. This kind of observatories were built until the last two decades of the 20^{th} century. The present tendency is different: the new big instruments and their auxiliaries are more specialized (which makes the projects cheaper) and are concentrated on 4-5 best sites in the world forming international complexes.

Table 1: Technical data about the telescopes at NAO "Rozhen"

Telescope	Field of view	Focal distance mm	Image scale	Limit magnitude (V)
2-m RCC	$1° \times 1°$ (30×30 cm) $5.5' \times 5.5'$ (CCD)	16 000	12.8 ″/mm (0.3 ″/pxl)	21^{m}
2-m RCC + focal reducer	$2.2° \times 2.2°$ $12' \times 12'$ (CCD)	7 200	28.65 ″/mm	22^{m}
2-m coude-focus	$3' \times 3'$	72 000	2.8 ″/mm	
coude-spectrograph (camera 3 + CCD)	200 Å	1 900	0.1– 0.2 Å/pxl	12.5^{m}
50/70-cm Schmidt	$5° \times 5°$ (16×16 cm) $27.6' \times 18.4'$ (CCD)	1 720	120 ″/mm	19^{m}
60-cm "Zeiss"	$20' \times 20'$	7 500	27 ″/mm	13^{m}

Three are the main criteria in choosing a site for a big modern observatory:
a) as low as possible latitude (to observe greater part of the sky);
b) as high as possible altitude (to avoid the dense and polluted air-layers) and dry climate (to facilitate the IR-observations);
c) as low as possible light pollution around the observatory.

Of course, an observatory in a small country like Bulgaria cannot meet perfectly the above criteria. Nevertheless our geographical characteristics are good enough: at a latitude ϕ=41° 41.5′ N it is possible to observe 80% of the sky and in principle the amount of the dark time reaches 80% of that on the equator; the NAO altitude falls within the altitudinal belt 1500-2500 m where most of the big world observatories are located.

The climatic characteristics [1] in this part of the *Rhodopes* (*Balkan high-lands* under UNESCO/UNEP classification) correspond to a rather mild climate with *positive* average temperatures practically during the whole year (+5.9° C for February and +12° C for August), low wind speed at this altitude (below 3.5 m/sec on average) but relatively high levels of humidity due to the forest terrains. As a result, the overall annual share (in hours) of the observing time do not exceed 40% and not only the clouds are the reason for the idle time but also the cloudless hours with great (>90%) moisture. Such a meteo-efficiency is not so bad: for comparison, the 1.5-m telescope at the Estonian observatory *Toravere* near Tartu (ϕ=58° N) carried out (according to its Annual Report) spectral observations during 47 nights (13%) in 2004, while the 60-cm telescope there was used photometrically for 15 nights only (4%). But the comparison with the best world sites shows that our NAO gives way: e.g., at CTIO (ϕ=30° S) the mean observing night is of 8 hours while at *Rozhen* it lasts only 5.5^h only. Statistically our most productive nights are in the autumn (September-October), but the seasonal differences for NAO are greater than these in the Chilean *Andes*.

The quality of the stellar image in the focal plane is, perhaps, the most important telescope parameter. In general, it is a function of both technical conditions of the telescope (optical performance and maintenance) and the atmospheric and surrounding the telescope air-layers. The resulting stellar image (*seeing*) is usually far from the perfect diffraction picture for a given optical system. The lower light-concentration in the resulting stellar image diminishes the accessible magnitude and, which is even more important, lowers the *spatial resolving power* of the telescopes. This atmospheric deterioration on the astro-images is a general issue for the earth-based telescopes. Even at the best sites the atmospheric seeing is not less than 0.2"-0.3" while the theoretical limit can be ∼0.02" – 0.01". That is why the most powerful and successful telescope of our epoch is HST – only 2.4-m in aperture it works above the atmosphere and fully realizes its diffraction limit of 0.03"!

In the last decade technical solutions (adaptive optics) appeared which make it possible to compensate in some way for the atmospheric turbulence. Our NAO has no resources for such equipment and we are forced to work with the mean for this zone atmospheric seeing of 2-3", seldom 1" and below. These circumstances influence the choice of the suitable for the 2-m telescope tasks – it seems that the instrument can be most effective in astro-spectroscopy and low-resolution morphologic imaging.

The situation with the light pollution around NAO, unfortunately, rapidly changes to worse. It is well known that the situation all over the world becomes worse and worse (see Fig. 4 based on [2] and [3]). Practically most of the "old" continental European observatories can no longer carry out serious scientific projects!

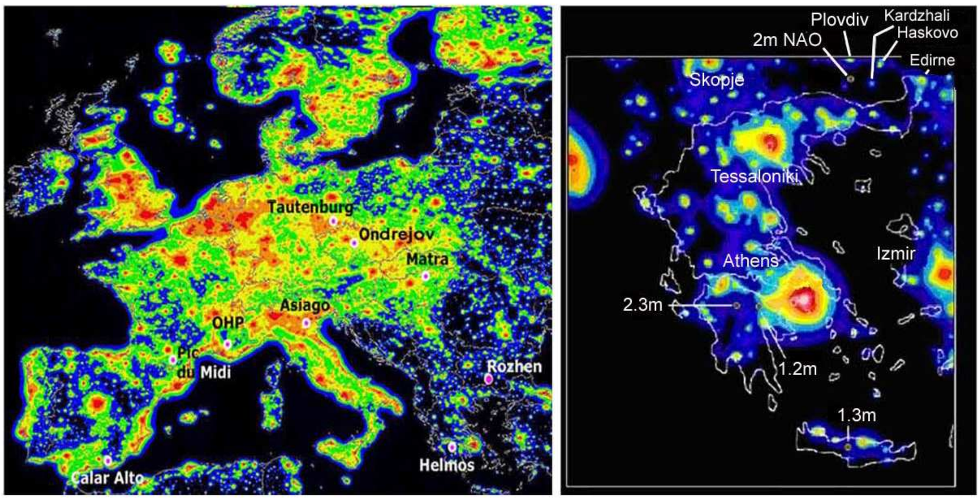

Figure 4: Light pollution above the European observatories in 2005 (left) and above Greece and the Rhodopes, 2003 (right).

Figure 5: The south horizon of NAO "Rozhen" on the evening of 13.09.2006.

The Balkans as a whole and especially the mountains there are still among the "darkest" European sites. But magapolises and big cities also grow and grow here (Athens, Istanbul, Thessaloniki, Sofia) and the over-illumination will increase rapidly. From this point of view the location of NAO is still more advantageous than, for example, that of the Greek observatories – Fig. 4. The new Greek observatory on *Helmos Mnt* (2350 m, with 5 M, 2.3-m telescope "Aristarchos") is only about a hundred km away from the 6-mln magapolis Athens–Piraeus and the telescope's eastern horizon should be heavily polluted! Unfortunately these conclusions cannot ease our minds. To the south of NAO there are at least 3 growing sources of parasitic light: the towns Smolyan (∼30000) and Chepelare (∼9000) and the winter resort Pamporovo. The last one is most harmful, being only 5 km away and on the same or greater altitude than NAO! The situation became extremely tense during the last years when the building activities expanded to an unseen extent (see Fig. 5 obtained by Dr. N. Petrov, NAO; Canon 1D, 10 sec exposition). This can seriously compromise the ability of NAO to provide high-quality scientific productions!

The first years of NAO coincided with the period of real "boom" in the world astronomy. If in the early 80-s our 2-m was still among the "big" telescopes, two decades later it already belongs to the university-class of "small" 2-3 meter instruments. Really, if at the end of 70-s there were about 30-40 telescopes of equal or greater diameter, now there are more than 120 such telescopes and about 20 mirrors have greater than 8 m aperture! Nevertheless, our 2-m remains among the ten biggest European telescopes situated on the continent.

Meanwhile the observational technology radically changed during the 80-s – 90-s. Electronic devices changed the prevalent photographic registration of the light and the introduction of solid-state CCD-detectors was especially successful. Our equipment was adapted in some way to the new situation, but up to now we have had no adequate park of CCD.

The main instrument at NAO – the 2-m RCC telescope, has two focal sites with a different scale: Ritchey-Chretien with a scale of 12.8?/mm over wide field of 1° and a coude-focus with a field of $3'$ and a scale of 2.8"/mm. Usually the equipment of such a telescope includes 5-6 different auxiliary instruments. In the RC-focus we dispose of two LN2-cooled CCD-cameras of class 1 x 1 K and scale 0.3"/pxl, a Peltier-cooled CCD-photometer and a powerful 2-channel focal reducer equipped with narrow-band filters and possibilities for low resolution ($\sim$1000) spectroscopy. In the coude-focus only a "classic" high-resolution horizontal spectrograph works. The gratings and cameras available give with the existing CCDs maximum resolving power R$\sim$30000. Now this value is rather in the range of moderate spectral resolution as the best world achivements lie around R$\sim$150000-200000.

The RC-equipment is good enough for implementation of wide set of projects – from studying of comets to stellar clusters, nearby and far galaxies, voids and quasars. Using photographic observations of the *Andromeda* galaxy back in the 80-es new data about the rotation and the spiral structure of this galaxy were obtained (G. Ivanov, Ts. Georgiev). Today dwarf-galaxies, galaxies with active nuclei, Seyfert galaxies, and galaxies with high surface brightness are successfully studied with the 2-m telescope and the Schmidt-camera (G. Petrov, Ts. Georgiev). Photometric investigations of gravitational lenses and quasars are in progress too (G. Petrov, B. Michov, A. Strigachev).

In the same RC-focus very important and widely known works on the morphology of the globular stellar clusters were carried out in the last two decades (N. Spassova, A. Staneva, Y. Borisova, H. Markov).

Quite successful is the program on cometary physics (V. Shkodrov, V. Ivanova, T. Bonev, G. Borisov). A matter of proud for NAO (and the Bulgarian astronomy as a whole) is the fact that in November 24, 1984 we were the first in Europe to take a photography of the *Halley's comet* during its last pass. Our colleague Dr. T. Bonev took part in the European team that observed the collision/clash of NASA's *Deep Impactor* spacecraft with comet *Tempel 1* on July 4, 2005.

Despite the low light efficiency (<5%) of the classic coude-spectrographs, the high optical and functional quality of our one allows successful observations of stars of up to 12^{th} magnitude with spectral resolution of 0.1-0.2 Å/pxl. At NAO a number of important long-term programs for studying different variable, eruptive and cataclismic stars were implemented (V. Dobrichev, B. Kovachev, D. Raykova continued their pre-observatory investigations with new material, obtained since the observatory began to operate). New generation investigators started their scientific activities here studying: hot stars (N. Markova, L. Iliev, H. Markov); symbiotic and related stars (T. Tomov, N. Tomov, D. Kolev, M. Tomova); Wolf-Rayet stars (L. Georgiev); chemically peculiar stars (I. Iliev, I. Barzova, Iv. Stateva; their works on the physics of λ *Bootis*-stars got a wide popularity); cataclysmic double systems (Z. Krajcheva, V. Stanishev, V. Genkov); late stars with chromospheric activity (R. Konstantinova-Antova, A. Antov). NAO successfully joined a number of international campaigns for studying exotic events. In 1990 here T. Tomov (now professor in *Copernicus-University*, Torun, Poland) observed a mass-loss with enormous velocity, 6000-7000 km/sec caused by the unusually strong jet-activity of the object *MWC560* and the star became a target for many telescopes for many years. An extremely powerful (more than 10000 Sun-luminosity) eruption of the star *V838 Monocerotis* in 2002 initiated a wide international effort to study this unusual event and our observatory also took part in the campaign. The spectacular light echo from this eruption was successfully imaged by our 2-m for several years.

The Schmidt-telescope already in the "photographic" era registered a vast plate-collection of star fields with variable and flare stars, galaxies and nebulae. A Rozhen catalogue of flare stars was published by M. Tsvetkov and K. Tsvetkova and under their initiative (in collaboration with K. Stavrev) a *Data base of wide-field observations* (www.skyarchive.org) was established and maintained under IAU supervision. The catalogue contains data about 117 glass-archives all over the world. As a whole these archives contain more than 640000 plates. Methods for access and processing of these massives is under development and it is quite in the main stream of modern organization of astronomical investigations.

Nowadays a Peltier-cooled CCD-camera with a chip of 1.5 Mpxl class is attached to the Schmidt-camera that gives new opportunities for efficient observations. Significant part of the observing time on this telescope is sheduled for cometary imaging and watching asteroid movements, including work on the program Near Earth Object (NEO) that aims to detect and catalogue the NEOs passing near the Earth (perihelion <1.3 AU). In general, the new asteroids, that were first detected at NAO "Rozhen", are more than 200. A dozen of them were named by our investigators (e.g. asteroids *Plovdiv, Kliment Ohridski, Bagryana, Atanasoff (John)*, etc.). Our foreign colleagues have named two asteroids after our active "asteroid-hunters" prof. *V. Shkodrov* and Dr. *V. Ivanova*.

The photometer on the 60-cm telescope (4-color UBVR system) is widely used (often in synchrony with the 60-cm telescope in Belogradchik AO) for observations of variable stars, stellar eruptions, asteroids (K. Panov, A. Antov, I. Barzova, Z. Donchev and others). With this telescope on November 2, 1991, Dr. K. Panov observed a giant eruption (over 7 magnitudes) of the star *EV Lacertae*.

Successful observations of solar prominences (N. Petrov, P. Duchlev, M. Dechev) are carried out with our self-made 15-cm coronograph since 2006.

These and many other works have contributed to build a good image of the Bulgarian astronomy.

2. 2. PRODUCTIVITY AND FUNDING

In general, we can be satisfied by the production of the Bulgarian astronomical community taking into account the conditions in our country. The observations at NAO "Rozhen" and Belogradchik AO are in the basis of most of the observational works. In the last decade the annual publications only of the Institute of Astronomy (IA) of BAS are between 50-70. About half of them are based on 2-m telescope observations. It should be noted that we do not have our own journal – practically all papers are issued in the international specialized journals. The publications based on the 2-m telescope for the periods 1995-2000 and the citation index for 2000-2004 are compared with that for other telescopes in Fig. 6 (based on data from [4]). These figures clearly show, in our opinion, two quite "natural" tendencies:

1) the telescope's productivity increases with the increase of its aperture (material is collected more quickly);

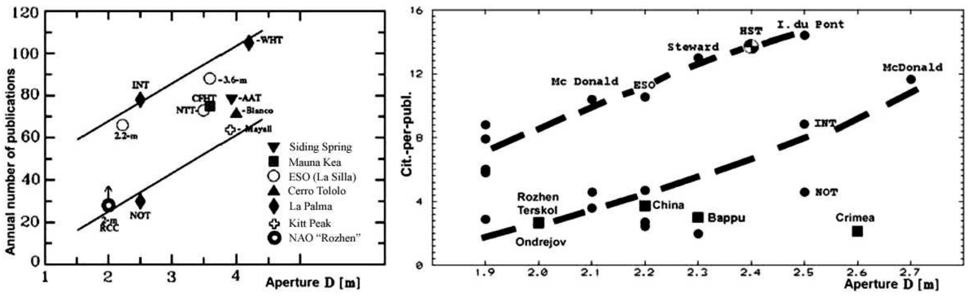

Figure 6: Publication index for the period 1995-2000 (left) and citation index for the period 2000-2004 (right) for telescopes of different aperture. The arrow attached to the sign for NAO at the left panel denotes the existence of not reviewed here papers published by foreigner authors.

2) the international "public" instruments are more productive – usually short programs of larger scientific teams are implemented on them. Besides, the language barrier could be also an important factor: the Anglo-Saxon community prepares publications easily and has easier access to the main astronomical journals issued in these countries.

There is one more fact to be noted about the citation index: the great country communities, mainly in USA and in UK are to a great extent "self-sufficient" and they more seldom cite other investigations, especially from small countries.

When looking at these ratings it is also clear that NAO follows closely the world trend. Such a conclusion is as welcome, as it is surprising taking into account the level of financial support of our astronomy (and the science as a whole)!

The NAO annual subsidy has for many years been some 100 K$ (as a whole, the IA BAS with scientific staff of ∼50 persons has a budget of ∼300 K$). About 50% are for salary and no money is allocated to upgrades and development of the instrumentation. Let us compare the situation with the good world practice (see Fig. 7).

The biggest world cluster of observatories is placed on Mauna Kea, Hawaii. The 3.6-m CFHT there serves a community of ∼2000 astronomers and has a budget of 6.2 M$ [5]. There too, about half of the budget is spent on salaries, but the share of R&D expenditure is 20%! The 3.8-m UKIRT has an annual subsidy of 2.2-2.5 M$ (∼50% personal and 12% R&D). The two Kecks, having stuff of 80 scientists, spend annually ∼10 M$, or 125 K$ per capita.

The European Southern Observatory (ESO) runs two observatories in Chile (*La Silla* and *Paranal*, and soon a 3^{rd} one – ALMA – will start to operate) with a general subsidy of ∼30-40 M. The bigest Russian observatory, SAO RAS with the 6-m BTA and the giant RATAN radio-antenna, was receiving financial support of up to 4 M$ a year in the last decade, according to the annual reports. The personnel expenditures there are also on the level of 42-45%.

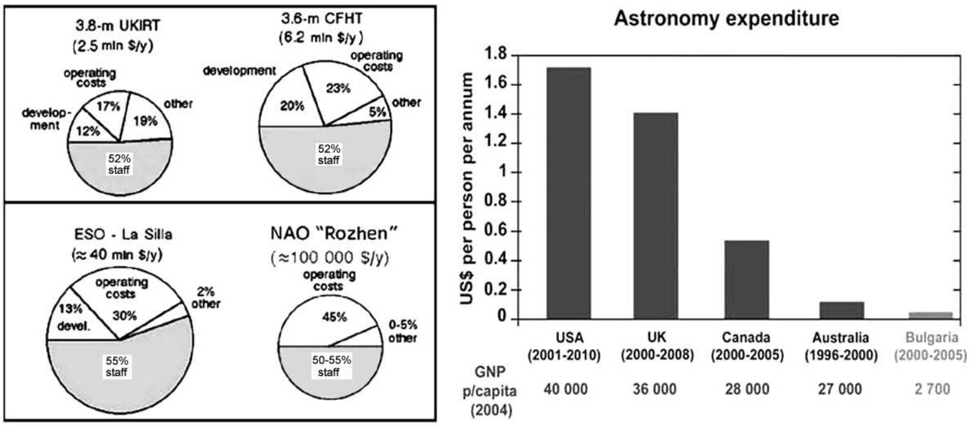

Figure 7: Budget of some observatories (left) and expenditures for astronomy per capita for some countries (right). The data for GNP are from [7].

The space programs need serious financial resources. The astronomical space projects supported by USA, UK or Canada are the reason for the significant differences in expenditures for astronomy per capita [6] in comparison with other countries (Fig. 7).

3. THE POSSIBLE FUTURE OF NAO "ROZHEN" (A PERSONAL VIEW)

The two generations of qualified Bulgarian astronomers that have grown up during the last three decades should be considered as the main result of NAO's existence. About 20 Bulgarian astronomers occupy now professor positions all over the world: we have our representatives in USA (Harvard, NASA, Lowel), Poland, UK, Sweden, Germany, France, Mexico, Chile, etc.!

But in the era of the existing and planned giant telescopes it makes sense to ask what can be the future of the small telescopes and observatories with limited funding? Obviously the "extreme" telescopes will pursue "extreme" scientific goals impossible to achieve with smaller instruments. On the other hand, the scientific interests of the astronomical community are much more diverse and most of these interests do not need "extremely large" equipment! The world astronomical community grows and grows and the telescopes' application time exceeds 3-4 times the allocated one. The spectrum of celestial events is wide and there are many important objects that have been studied for quite a long time with "the old small instruments" and they need keeping a close watch on them. Therefore it is much too early for our 2-m and the similar in size telescopes to be retired (e.g., see [8]).

It is clear that we must conform to the worldwide tendencies in the scientific practice which are not only to enlarge and to sophisticate the equipment, but also to *change the organization and the investigation methods of this science itself*! The information stream flowing from the present telescopes becomes so great that it can be no longer processed using the former methods. Hundred of Tb (1 Tb=1000 Gb) are already collected and soon Pb (petabyte=1000 Tb) "rivers" will flow! A global system of databases connected in a common net is being set up: the *Virtual Observatory* (http://www.ivoa.net/Documents/latest). The national communities can refer to its resources in order to perform studies using cross-extractions from already collected data in many observatories.

Furthermore, the great astronomical projects become so expensive that it is impossible for a single country to carry them out alone: the international co-operation is of ultimate necessity. And the only way for investigators from small countries to get involved in the world scientific efforts is to join such international collectives. Therefore, the future of the Bulgarian astronomy (as well as that of any other European one!) cannot be considered beyond such institutions like ESO – the European astronomical scientific organizations that focus the efforts and resources of many countries.

At the same time, it remains of great importance for every national astro- community to have its own *meeting, teaching* and *training* resources and the future of existing facilities like our National Astronomical Observatory can easily be seen in such a niche. It possesses all to become an *international regional centre for conferences, education and training* of young astronomers. NAO has many advantages: accommodation base with lecture halls and equipment, good infrastructure (easy access – only 80 km away from the second largest city in Bulgaria – Plovdiv; nearby resorts), nearby city with good Planetarium – Smolyan, pleasant nature and, finally, still suitable astronomical instrumentation.

In such a way, possibly, the National Astronomical Observatory at Rozhen could be preserved as a scientific centre that will continue to contribute not only to the Bulgarian intellectual potential.

References

[1] *Състояние на околната среда, Годишник 2001 г*, МОСВ, РИОСВ-Смолян, Смолян, 2002, с. 15-16.

[2] Cinzano P., Falchi, F., Elvidge, C. D.: 2001, "The first World Atlas of the artificial night sky brightness", *Mon. Not. R. Astron. Soc.*, 328 (3), 689–707, (astro-ph/0108052)

[3] www.astro.noa.gr/iaa_main.htm

[4] Trimble, V., Zaich, P., Bosler, T.: 2005, "Productivity and impact of optical telescopes", *PASP*, **117**, 111.

[5] CFHT – Annual Report: (2002, 2003, 2004)

[6] *Beyond 2000: The Way Ahead. A Mid-term Review of "Australian Astronomy:Beyond 2000"*, Australian Research Council, June 2001, p. 13 (http://www.arc.gov.au/pdf/01_02.pdf)

[7] http://www.finfacts.com/biz10/globalworldincomepercapita.htm

[8] Djorgovski, S. G.: 2003,"The Roles of Small telescopes in a Virtual Observation Environment" in: Small Telescopes in the New Millenium I. Perceptions, Productivity and priorities, ed. T. Oswalt, Kluwer, Dordrecht, p. 85, (www.astro.caltech.edu/~george/vo/smtelvo.pdf)