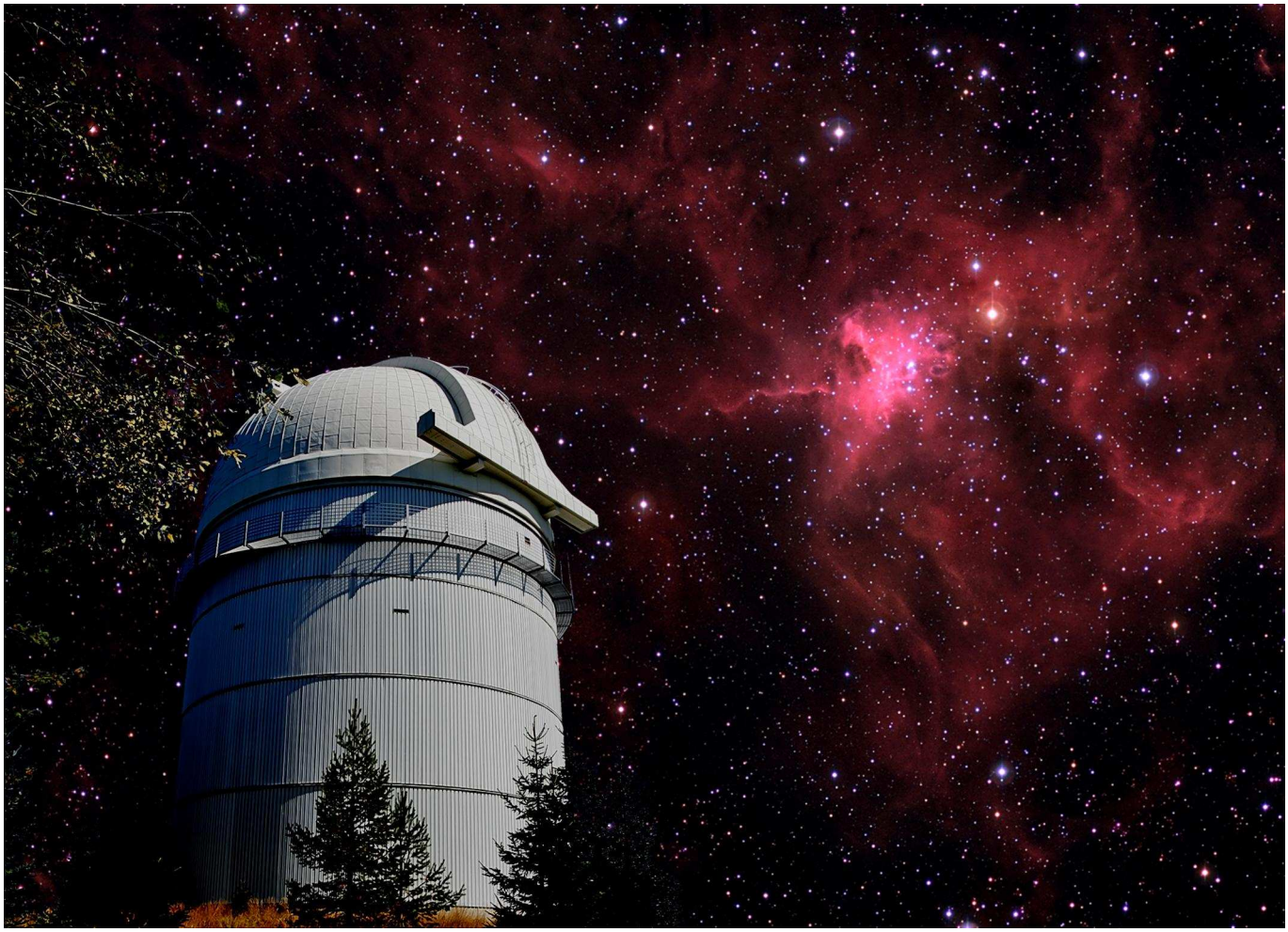
Регионален Астрономически Център
за Изследвания и Образование
(**РАЦИО**)

Regional center for astronomical research and education



Проект
за изграждане на научно-образователна инфраструктура
София, май 2009

Project for the building and development of
an infrastructure for research and education
Sofia, May 2009

Пътна карта за научноизследователски инфраструктури

Регионален **А**строномически **Ц**ентър за **И**зследвания и **О**бразование (**РАЦИО**)
Regional center for astronomical research and education
(**RACIO** - abbreviation comes from the Bulgarian title)

Проектно предложение за международно валидиране на научноизследователски комплекси

Short description of the network of institutions (Описание на мрежата от институции – представя се кратко описание самостоятелно за всеки партньор в мрежата, като се дава информация само за звеното, което има компетентност да работи по съответната научна тематика.)

The proposed Research Infrastructure (RACIO) unites the leading astronomical research and education facilities in Bulgaria, thus closing the "knowledge triangle" (research - education - innovation). These are: The National Astronomical Observatory - Rozhen (NAO, http://docs.astro.bas.bg/~nao/index.htm), Astronomical Observatory – Belogradchik (BAO) and Institute of Astronomy, Bulgarian Academy of Sciences (IA, http://www.astro.bas.bg/); Department of Astronomy, Sofia University "St. Kliment Ohridski" (SU, http://www.phys.uni-sofia.bg/~astro/); and Astronomical Center, Shumen University "Konstantin Preslavski" (ShU http://astro.shu-bg.net).
RACIO has the advantage of building upon already existing facilities. Over the past three decades the NAO has had an important role in the astronomical research in South Eastern Europe. Its scientists together with the scientists from the other RACIO members are recognized as leading astronomers in their respective fields of research. The NAO is also the birth place for a number of international projects. Researchers from almost all European countries and USA are working together with their Bulgarian colleagues in the framework of bilateral or multilateral projects.
A detailed description of IA (including NAO and BAO), Dept. of Astronomy at SU, and Astron. Center at ShU are given in Annexes I, II, and III, respectively.

Description of existing similar RIs (Описание на съществуващи подобни мрежи, ако има такива и възможности за съвместна работа с тях. (например наличие на стабилни партньорства, общи европейски и/или регионални проекти, съвместни конференции, обмен на учени и докторанти и т.н.))

The existence of state-of-the-art research infrastructures (RIs) is the main prerequisite for successful development of science and technologies. Numerous examples of RIs dedicated to the promotion of science can be found throughout Europe. Often such structures combine research and educational departments, a principle which is considered as the basic characteristic of the organizational structure of RACIO. In Germany, for example, International Research Schools were established at several Institutes of the Max-Planck Gesellschaft (MPG http://www.mpg.de/). In France, there are similar organizations combining research and higher education working under the rules of Unité Mixte of the CNRS (see e.g. description of our partners LAOG and CRAL below).
Presently, a substantial percentage of the students graduating at the Astronomy Department of SU continue their education in these organizations.
Astronomers from IA, SU, and ShU have partners and work actively in joint projects with colleagues from almost all European countries. Here are some examples:

- Bilateral Academic Project with Royal Observatory, Belgium, Spectral and Photometric Follow-up Studies of Binary Systems of Special Interest Stars;
- DFG project with Astrophysikalisches Institut Potsdam, Germany, Wide-Field Plate Database: Development and Applications in the Observational Astronomy;
- UK exchange program, Wind structure and the nature of mass loss in massive stars;

·Bilateral Academic Project with AAS Austria, “Stellar seizmology: spectroscopy of short-period pulsators”

·Project sponsored by UNESCO-ROSTE/ HM/hm/05/1442 (2006), Enlargement of Collaboration in Ground-Based Astronomical Research in SEE countries: variable stars and studies of small bodies of the Solar System, etc.

RACIO will be a powerful tool for strengthening the co-operation within these bilateral and multilateral projects. The modernization of the NAO facilities will increase its role as the natural centre for astronomical research and education in South-Eastern Europe. RACIO could develop to become a centre offering excellent environment for front-end research. Unique technological solutions could be tested here and offered to the astronomical community all over Europe.

Recently, Bulgaria was recognized as an associate member of ASTRONET (http://www.astronet-eu.org/). With the establishment of RACIO it will be possible to join OPTICON (Optical Infrared Coordination Network for Astronomy, http://www.astro-opticon.org/) as well.

Description of the existing infrastructure (Описание на наличната инфраструктура в съответните звена, допълняема ли е тя към други структури, където има сходно оборудване, в т.ч. и регионални и европейски такива)

The existing infrastructure of IA, NAO, and BAO is described in Annex I, the infrastructures of SU and ShU are described in Annex II and Annex III, respectively. The upgrade of the existing infrastructure and the addition of new components will establish RACIO as an unique RI. Thus RACIO could become an important complementary element in the set of European research infrastructures in the field of astronomy.

e-infrastructure. How is it integrated with the existing EU e-infrastructure. (E-инфраструктура – необходимост; интегрираност със съществуващите електронни масиви)

RACIO has a well developed local e-infrastructure. It will be connected to the rest of the world by integrating NAO into the Bulgarian Research and Educational Network (BREN, http://www.bren.acad.bg/en/) which is the regional component of GEANT. RACIO will also use European e-infrastructures such as the AstroGrid (UK), the AstroGrid-D (Germany) etc., following the European Virtual Observatory (VO, http://www.euro-vo.org) initiatives. In addition, through a Bulgarian VO portal (http://www.bgvo.org/) its control systems, observational data gathering and generated data bases will be designed using the most suitable VO standards with the aim to facilitate the open access to the European astronomical community. RACIO will be a part of the already existing grid e-infrastructure, the Bulgarian Grid Consortium (http://www.grid.bas.bg/site/index.php?page=members). In fact, the RACIO partners are already members of this national grid initiative.

Description of the available scientific and technical personnel (Описание на научния и технически персонал, работещ в описаното в т. 1 звено в т.ч. необходимост от нови работни места. Необходимо е да се представят кратки автобиографии на всеки от екипа и тяхната квалификация и опит (публикации, патенти, участие в международни, в т.ч. европейски и регионални проекти и инициативи и т.н.))

The description of the scientific and technical personnel of the partner institutions is given in Annexes I, II, and III. Short CVs of the Heads of the partner organizations are given in Annexes IV, V, and VI, respectively.

The Heads of the partner institutions are:

Dr. Tanyu Bonev, Assoc. Prof. – Director, Institute of Astronomy and NAO-Rozhen,

Dr. Valeri Golev, Assoc. Prof. – Head of Department Astronomy, Physics Faculty, Sofia Uni,

Dr. Sci. Diana Kyurkchieva, Prof. – Head of Astronomical Center, Shumen University.

Other key persons in the project are: (a) from the IA and NAO - Dr. Alexander Antov, Dr. Evgeni Semkov, Dr. Nevyana Markova, Dr. Ilian Iliev, Dr. Rumen Bachev, Dr. Haralambi Markov, Dr. Anton Strigachev, (b) from SU – Dr. Petko Nedialkov, Dr. Antoaneta Antonova, Dr. Evgeni Ovcharov and (c) from ShU – Dr. Dragomir Marchev.
Estimates show that the maintaining and exploitation of the new state-of-art facilities in the fully operational state needs additional highly qualified staff amounting to about 20% of the present personnel.

Science case and socio-economic impact (Дефиниране на целите на проекта – научни теми и проблеми, по които ще се работи, значимост на изследванията за решаването на социални и икономически въпроси, възможности за развитие на нови научни направления, възможности за предоставяне на различни услуги за учените и бизнеса, както и обучение на студенти, докторанти, млади и утвърдени учени и др.)

The new RI RACIO will expand the scientific horizon for New scientific problems, related to the Bulgarian astronomy. The well established fields of research such as Sun, Solar System, Non-stationary Stars, Chemically Peculiar Stars, Stellar Atmospheres and Envelopes, Stellar Clusters, and Galaxies will receive new and more effective opportunities given by the planned modernization of the existing infrastructure and addition of new observational equipment. Some of the priority research topics (new and already established) is given below:

- Quantitative spectroscopy of hot massive stars
- Mass and radiation transfer in stellar atmospheres. Chemical evolution of the Galaxy.
- Interacting binary systems
- Research on weakly studied and new eclipsing binary stars with oscilating components /oEA/
- Activity and magnetic fields of very low-mass stars and brown dwarfs
- Activity in late type giant stars
- Extra Solar planetary systems
- Astroseismology – non-radial stellar pulsations
- Photometric, spectral and polarimetric study of the Solar system bodies (main belt objects, Troyans, trance-Neptune objects and comets.)
- Observations of Near Earth Objects (NEOs) and non-functioning remnants of artificial cosmic bodies or apparatuses in Earth orbit.
- Spectral observations of W UMa type stars.
- Spectral observations of cataclysmic stars

Important for the achievement of the scientific goals listed above is the planned network of small and medium, robotic and automated telescopes. The scientific impact of the small and medium sized telescopes can be optimised by co-ordination at the European level. Building upon the existing experience and taking into account the guidelines outlined in the ASTRONET's Science Vision and Roadmap RACIO will also focus on the following scientific areas which proved to be of major interest to the astronomical community worldwide:

- optical imaging and surveys complementing the results of leading EU observational facilities (existing and forthcoming)
- integrated participation in telescope networks for long-term photometric and spectroscopic surveys
- ground-based support of space missions (e.g., GRB follow-up, GAIA (http://gaia.esa.int/, Rosetta http://rosetta.esa.int/, etc.)
- theoretical modelling and numerical simulations of astrophysical processe
- providing opportunity for high-risk, long-term or classical observations which are unlikely to be allocated time at the large instruments

• providing opportunity for the testing of innovative new instruments and observational techniques
•training and education activities
•public outreach

Together with the already established close collaboration between countries in South - Eastern EU (see e.g. SREAC http://www.astro.bas.bg/SREAC/statute.html), RACIO will act as a catalyst for further collaborations at regional and pan-European levels. By means of transnational access contracts, bilateral/multilateral agreements and specific mobility schemes it will enable astronomers from other SE European countries to access modern observational facilities and state-of-the-art methods for astronomical research that would otherwise be unaffordable.
Upgrading and modernising its observational facilities and providing adequate scientific, technical and logistical support, RACIO will become more attractive to external users to perform their own or collaborative research programmes. Consequently RACIO will become a valuable member of the OPTICON transnational access programme. RACIO will support the development of the Bulgarian Virtual Observatory (http://www.bgvo.org) facilitating its efforts to effectively join the International Virtual Observatory Alliance (IVOA, http://www.ivoa.net).
The astronomical community in Bulgaria has long-term experience in organising and performing National and International Astronomical Schools (e.g., http://www.geocities.com/astroschool2006/ and http://astro-brezi.org/). These schools provide opportunity to students of all levels and young astronomers to gain practical observational experience at various telescopes and to obtain knowledge of data processing and analysis. RACIO will continue the training and educational activities described above and extend to European scales by joining the NEON consortium (http://eas.iap.fr/neonNew.html) .
In general terms, the RACIO project aims at providing a range of support actions to assist the participation of SE European countries to the pan-European initiatives by establishing a RI that will expand and support the ERA in the region.

Science and technology are major driving forces of modern society and contribute to many aspects of public and personal lives, often in a complex and unpredictable way. Therefore it is hardly possible to assess the direct importance of science and technology (A.F.J. van Raan, 2000, 'R&D evaluation at the beginning of the new century, Socioeconomic impact of R&D', *Research. Evaluation*, 8, 2, 81-86). Economists have deducted that typical rate-of-return criteria do not apply to R&D (Van den Beemt, F.C.H.D. 2000. 'Grasping the ungraspable: assessing the contribution of academic research to economic utility', PhD thesis, University of Leiden.). Instead, the fundamental sciences and astronomy in particular has a deep indirect impact on the society and civilisation as a whole. For example, astronomy affects the advancement in areas such as navigation, space flight, satellite communications and software development.
RACIO's socio-economic impact will be considerable. The direct short-term yet long-lived impact involves the attraction of more students, young researchers and engeneers to the field. The modern competitive environment offered by the proposed infrastructure will benefit both the reintegration of young scientists and the education and training of students at high school and university levels. In addition, RACIO will provide Bulgarian astronomers with a more extended base for future inter-institutional and international collaborations, feeding astronomical training schools and workshops for young astronomers, students and PhD students and supporting scientific collaboration in joint projects and observational programs with astronomers throughout the EU.
The planned public outreach will bring astronomy closer to the general public, better the public understanding and thus contributing to the development of the knowledge society.

Relevancy of the project's goals to the National and European strategic documents (Релевантност на целите на проекта с националните и европейски стратегически документи.)

Astronomy is the oldest science and the one with the greatest long-term impact on civilisation. Some of the most significant breakthroughs in modern technology are direct results from the astronomical research. Europe is a leading centre for astronomy interpreted in its widest context, encompassing observational and theoretical work on the constituents of the Universe from the near-Earth environment to the distant Cosmos, and including laboratory studies, education and outreach. That was the main reason why the UN chose 2009 to be an International Year of Astronomy (IYA 2009, http://www.astronomy2009.org).
Major European facilities such as ESA and ESO have a leading role in European astronomy yet do not cover all astronomical disciplines or all of Europe. Since 2005 ASTRONET, an EC-funded ERA-NET, is developing a strategic plan for Pan-European Astronomy (including both Science Vision and Infrastructure Roadmap) for the next 25 years. Such large-scale long-term co-ordination and co-operation is needed to address the modern scientific challenges. To become a competitive partner in such pan-European endeavors and to address the acknowledged shortage of students and young researchers in the field Bulgaria needs a well-developed local infrastructure. Following the example of other European countries this infrastructure will combine the resources of research institutes and university units.
With joint efforts they are looking for answers of the key questions of contemporary astronomy summarized in the Science Vision developed by ASTRONET in 2007 as follows: (A) Do we understand the extremes of the Universe? (B) How do galaxies form and evolve? (C) What is the origin and evolution of stars and planets? (D) How do we fit in? The successful continuation of these research activities, however, depends both on the human resources involved and the upgrade of the existing facilities which are foreseen in RACIO. The greatest effect is expected by attracting more young people to astronomy. The synergy between research and education, which is one of the components in the proposed RI, is considered the main driver of this process.

Technical case: summary of results (technical specifications) of conceptual and/or technical design studies (Необходимост от специализирано доизграждане, дооборудване, в т.ч. и електронен достъп, придружено със съответните технически и финансови показатели и мотивировка как това ще доведе до определена добавена стойност за обществото и икономиката)

Technologically, the implementation of RACIO involves the renewal and rehabilitation of the existing astronomical facilities in Bulgaria, and the construction of completely new components. The renewal and rehabilitation represents modernization of the control systems (CS) of the available telescopes. The planned new components are: (1) construction, manufacturing and commissioning of an echelle spectrograph for the 2-meter telescope and (2) purchasing of a two 1.2 m remote-controlled (in perspective robotic) telescopes (estimated cost 900 000 EU each) that will operate in fully unattented mode as a pair of robo-telescopes deciding about the best observing strategy on the fly. The single building (144 000 Euro) which will host them will also be automated.
The realization of step (1) will increase the usage effectiveness the 2-meter telescope and its reliability. The design of new CSs for the telescopes (750 000 EU) has already a pan-European character – by default, according to the legal regulations, it will be implemented after an open tender on European level. One of the potential participants in this procedure is the Czech company ProjectSoft (www.projectsoft.cz) which in 2007 and 2008 has successfully designed and put into operation CSs for two other telescopes of the 2-m telescope class manufactured by the Carl-Zeiss-Jena factories (http://www.zeiss.de/), the telescope of the Tautenburg Observatory, Germany (http://www.tls-tautenburg.de/), and the Ondrjeov observatory telescope, Czech Republic. Another pan-European dimension of this

proposal is the requirement for the new CS to be manufactured exclusively with industry controllers produced by Siemens (www.siemens.de). This will guarantee the high reliability and long life of the system and, in parallel, will offer the flexibility needed for the system maintenance. The standard controllers will also provide the opportunity to combine the telescope and its auxiliary units in a sophisticated integrated body of instruments (the detectors presently used at the telescopes are described in http://docs.astro.bas.bg/~nao/telescopes/fr_en.htm, details for the autoguiding system can be found in http://www.astro.bas.bg/~tbonev/Autoguider/Autoguider.html).
The implementation of the second major component of upgrading the existing infrastructure, the echelle spectrograph, will place RACIO at the forefront in the field of contemporary astronomical spectroscopy. It will provide full coverage of the visual spectral region at a high resolving power (R ≈ 45000). The current plan foresees the design, assembly and alignment of the instrument to be done at the University and Observatory in Heidelberg (www.lsw.uni-heidelberg.de/projects/instrumentation/Feros/) with the participation of RACIO's young scientists. Such cooperative work will provide the Bulgarian young scientists with unique opportunities for practical mastering of contemporary technologies and astronomical instrument design methods. The thus acquired knowledge and skills will be a prerequisite for the future technological development of RACIO. The estimated costs for the echelle spectrograph are 840 000 EU.
Another important part of the RI plan is the building of a new observational facility on the territory of the NAO Rozhen. Preliminary design studies have shown that most suitable for the purpose is a pair of 1.2-meter Ritchey-Chretien reflectors with corresponding auxilliary instrumentation at all four available Nasmyth foci. The estimated costs of this auxiliary instrumentation and robotization is approximately 1 200 000 EU. A possible manufacturer is the company Halfmann Teleskoptechnik (http://www.halfmann-teleskoptechnik.com/). This kind of telescopes is characterised by high speed slewing, high accuracy of pointing, and high accuracy of tracking. A motorised movable mirror provides access to both Nasmyth foci and allows fast switching between them. If appropriate instruments are mounted at each focus, a fast change will be possible from spectral to imaging (photometric) mode and vice versa. Being capable to be robotized, the telescope pair will be able to autonomously perform scheduled scientific observational programmes like the program of the robo-telescope pair STELLA-I and STELLA-II (http://www.aip.de/stella/) of the Astrophysical institute of Potsdam and Instituto de Astrofisika de Canarias (http://www.iac.es). This pair of robo-telescope could be used remotely by high school-, university-, and PhD-students worldwide for educational purposes.

Other expected socio-economic impacts: development of new technologies, effects on training, involvement of industries, regional impact, other (Възможности за предоставяне на специализирани услуги, в т.ч. образователни или обучителни на национално, регионално (в т.ч. Черноморски, Средиземноморски и др. неевропейски зони) и европейско нива.)

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Identifying additional partners from the private and/or public sectors (Идентифициране на други партньори от частния и публичния сектори, освен предварително дефинираните такива, както и възможности за концентрация на научни екипи (не само национални), които да работят по определена научна проблематика)

Halfmann Teleskoptechnik GmbH & Co. KG
Gessertshausener Str. 8
D-86356 Neusäß-Vogelsang
Germany
http://www.halfmann-teleskoptechnik.com/htm/contact.htm

Tuparev Technologies
3 Sofijski Geroj Str.
BG-1612 Sofia
Bulgaria
http://www.tuparev.com/

Astrophysikalisches Institut Potsdam
An der Sternwarte 16
D-14482 Potsdam
Germany
http://www.aip.de/

Max-Planck-Institut für Sonnensystemforschung
Max-Planck-Straße 2
D-37191 Katlenburg-Lindau
Germany
http://www.mps.mpg.de/

Zentrum für Astronomie der Universität Heidelberg
Landessternwarte
Königstuhl 12
D-69117 Heidelberg
Germany
http://www.lsw.uni-heidelberg.de/

Armagh Observatory
College Hill, Armagh
BT61 9DG, N. Ireland
UK
http://www.arm.ac.uk

Department of Information Technology, National University of Ireland, Galway,
Newcastle Road, Galway,

Republic of Ireland
http://astro.nuigalway.ie/

Laboratoire d'Astrophysique (LAOG)
Observatoire de Grenoble
Unité Mixte de Recherche (UMR 5571)
BP 53
F-38041 Grenoble Cédex 9
France
http://www-laog.obs.ujf-grenoble.fr/

Centre de Recherche Astronomique de Lyon (CRAL)
Observatoire de Lyon
Unité Mixte de Recherche (UMR 5574)
9 avenue Charles André 69561 Saint Genis Laval cédex
France
http://www-obs.univ-lyon1.fr/

and others (ESO, OPTICON etc.)

Costs for construction, operation and decommissioning, indications on project financing. (Остойностяване за период от 5 години в т.ч. и план за възможните източници на финансиране в рамките на първоначалния петгодишен период с акцент върху следващ поне седемгодишен период)

Подготвителна фаза (общо)
Фаза на изграждане (доизграждане; модернизиране и т.н.)
Оперативни годишни разходи

Echelle spectrograph for the 2-m telescope of NAO Rozhen			0.840 M€
New control systems for the existing telescopes			0.750 M€
2 x 1.2 meter robo-telescopes and dome			1.944 M€
Instrumentation for the robo-telescopes			1.200 M€
Rennovation of the buildings			0.900 M€
Operational costs (1.2 M€/year, based on the funding of the existent participants) total for the first 5 years			6.000 M€
Total current investments by the participants 12 M€	Total (new) construction cost 11.634 M€	Operation cost /year 1.833 M€ (new and existing)	Decommissioning cost -

(of which already spent or committed) (this are the costs already spent for creation and funding the operation of the existent participants and resources in the RI)	(specify contributions committed or indicated by possible funders) (funding is expected in the framework of this project)	(specify contributions by possible funders) 1.200 M€/year (RACIO's budget) 0.500 M€/year (BAS) 0.100 M€/year (SU) 0.033 M€/year (ShU) (these costs are estimates for 2009. For the next years they may increase proportionally to the inflation).	(possible funders) No decommissioning is planned. The proposed infrastructure will serve for basic research and will only develop in the future to meet the ever increasing scientific and technological challenges in astronomy.

Possible construction works. (Необходимост от строително-монтажни дейности, придружен с нагледен материал за евентуалните обекти, които се нуждаят от обновяване)

Renovation and rehabilitation of the existing buildings is needed. The aim is to improve the working and living conditions for the observers and the other personnel at the observatories. An additional result will be the increase of energy efficiency of the buildings, thus decreasing running costs. For these renovations we estimate a total cost of 0.9 M€.

Commitment of the institutions and support from potential partners (Обвързаност на институциите и подкрепа от потенциални партньори)

Institutions which might show interest in this Project (apart from the governing bodies of the partners included in RACIO) are:
(1) The Bulgarian National Science Fund (http://www.nsfb.net/) which can partly support the future exploitation of this RI, granting research projects based on using the new and upgraded facilities;
(2) European regional development fund, European social fund, etc. Partial renovations and rehabilitation of RACIO in the future could be implemented with funding from the European structural funds;
(3) The South East Europe Operational Programme (http://www.eufunds.bg/) could fund transnational access to the infrastructure;
(4) about 10 Bulgarian Public Astronomical Observatories and Planetariums can use RACIO for teaching and research purposes.
Finally, the upgraded science infrastructure at the National Astronomical Observatory "Rozhen" will enhance the local socio-cultural climate and, being attractive object for cultural tourism, will reinforce the potential of the Smolyan district as a tourist destination of international interest.

Coordination and management (Тип на координация и управление – според вида на научната инфраструктура дали е самостоятелно ситуирана или изисква разпределена форма.)

- The project management is accomplished by the Project Leader (Project Coordinator is a synonym in this case), supported by:

- **Project Secretary**
- **Coordinators and**

- **Commissions (Boards)**
  who are using pre-defined
- **Tools**

and

- **Rules for decision making**

This structure of the project management is developed to guarantee the successful completion of the scientific goals and objectives and the timely realization of the technological steps planned. The structure should secure (a) an effective decision making, (b) a good environment for internal communication, and (c) the technical and administrative servicing of the project.

The Project Leader, the Secretary and the Coordinators participate in the Project Managing Commission (MC).

1. Project Leader (PL)

The PL coordinates the overall activities during the realization of the project. He maintains operatively the communication with external organizations (national and international) which are directly connected with the achievement of the project goals and objectives, as well the communication with the organizations which are directly related to the financing and implementation of the project:

2. Secretary

The Secretary assists the PL in the project management, supported by the technical coordinator and by the scientific coordinator. Her/his basic responsibility is to check if the planned actions are carried out in accordance with the project schedule. The secretary is responsible for the maintenance of the project documentation and archive.

3. Coordinators

3.1. Technical Coordinator (TC):

The technical coordinators keeps track of the timely implementation of the technical activities planned in the project. During the first phase of the project (development and modernization of the RI) he/she is responsible for the agreements, delivery, and commissioning of the planned new instruments and other equipment. During the second phase of the project he/she checks the proper use of the equipment and, when necessary, organizes the warranty and after-warranty maintenance of the equipment.

3.2. Scientific Coordinator (SC):

The Scientific Coordinator controls the achievement of the project scientific objectives. The role of the SC is particularly important during the second phase of the project (exploitation of RACIO), when a great part of the technological renovation of the RI will be complete. During this phase, the responsibility of the SC will be to create optimal conditions for effective utilization of the new equipment with the aim to achieve the scientific goals of the project.

3.3. Coordinator for Public Relations (CPR):

The Coordinator for Public Relations is responsible for publicizing the activities performed in the framework of the project. The CPR will be responsible for contact with the media, as well as the regular preparation of press releases, public outreach matherials etc.

4. Commissions (Boards):

4.1. Project Management Commission (MC). The role of this commission is to plan operatively the steps to be done to achieve the strategic objectives of the project. Chair of this commission is the PL and members are the Secretary and the Coordinators.

4.2. Technical Commission. The Technical Commission controls the activities connected with achievement of the technical objectives of the project. Chair of this commissionm is the Technical Coordinator, and the members are appointed by the Project Management Commission.

5. Tools:

5.1. Documentation and Archive – The project files are maintained by the project Secretary. The project documentation includes minutes from the meetings of the commissions, correspondence with the funding institutions, technical specifications, research papers, publications in the press, and other documents related to the realization of the project. The project Secretary keeps a log-book in which enters all operational decisions and activities of the project Coordinators.

5.2. Dispute resolution – all conflicts will be resolved by voting inside of the Project Management Commission. Simple majority will be sufficient to take a decision.

5.3. Reports for the implementation of the project. They are prepared by the Coordinators at fixed time intervals the length of which will be set by the Project MC, yet not longer than 6 months. Following these reports, reports for the funding organization(s) will be prepared together with a plan for the succeeding period.

6. Rules for decision making

6.1. Operational decisions – operational decisions aiming to achieve given project objectives are taken by the corresponding Coordinator who then informs the Project Leader and the Secretary adds the report to the project files.

6.2. Management decisions – decisions related to changes in the project parameters (changes in the schedule, reallocation of budget and/or resources, etc.) must be taken by the Project Management Commission.

Timetable (Индикативен график)

<table>
<tr><th>2009</th><th>2010</th><th>2011</th><th>2012</th><th>2013</th><th>2014</th><th>2015</th></tr>
<tr><td>Establishing the organizational structure of RACIO</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Echelle-spectrograph design and manufacturing</td><td></td><td></td><td></td><td></td></tr>
<tr><td>New control system for the 2-m telescope</td><td colspan="3">New control systems for the smaller telescopes (1 telescope/year)</td><td></td><td></td><td></td></tr>
<tr><td>Negotiations and contract for the pair of new, 1.2-meter telescopes</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="3">Dome for the new pair of telescopes, planning and building</td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="2">Defining, negotiating and purchase of the instruments for the pair of new telescopes</td><td colspan="2">Mounting and commissioning of the pair of new telescopes</td><td></td><td></td></tr>
<tr><td colspan="4">Headquarters (if approved) – planning and building
Renovation/rehabilitation of the existing infrastructure</td><td></td><td></td><td></td></tr>
<tr><td>Preparatory phase</td><td>Construction phase</td><td colspan="2">Operation</td><td colspan="3">Decommissioning</td></tr>
</table>

Contact person (Лице за контакти)

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Annex I

Institute of Astronomy
at the Bulgarian Academy of Sciences

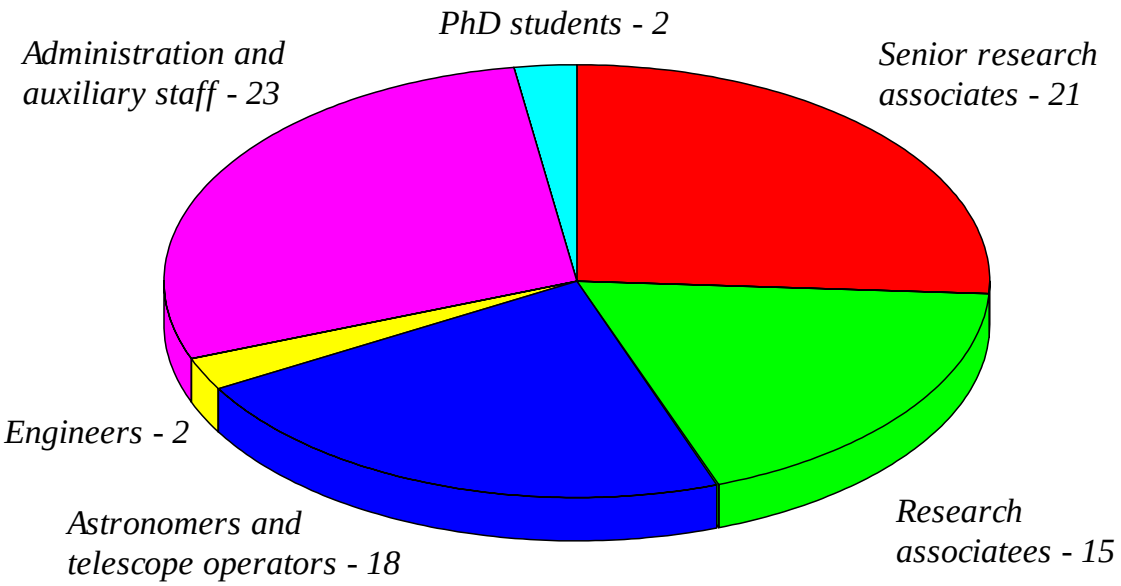
Contents:

1. The Institute

The Institute of Astronomy (IA) is the largest institution in Bulgaria for professional astronomical research. It was founded in 1995 as the successor of the Department of Astronomy (DA) with National Astronomical Observatory. The DA at the Physical Institute of the Bulgarian Academy of Sciences (BAS) was founded in 1953 and from 1958 it became a self-dependent branch of BAS.

The Institute of Astronomy carries out fundamental research in observational astronomy, as well as theoretical investigations on the origin and evolution of cosmic objects. In correspondence to the fields of research, the scientific activities of IA are distributed among seven departments: Sun, Solar System, Non-stationary stars, Stellar atmospheres and envelopes, Chemically peculiar stars, Stellar clusters, and Galaxies. IA has scientific relations and co-operation with other institutions in Bulgaria having astronomical departments: the Space Research Institute of BAS, the Sofia University Faculty of Physics Department of Astronomy, and the Shumen University Department for Applied and Theoretical physics. Partner organizations of IA abroad are more than 100 institutions from Austria, Belgium, Canada, Estonia, France, Germany, Greece, Hungary, Italy, Japan, Poland, Romania, Serbia, UK, USA, Russia, Ukraine, etc. IA is an active partner in the SUB-REGIONAL EUROPEAN ASTRONOMICAL COMMITTEE (SREAC), sponsored by UNESCO-BRESCE.

The present staff of the IA includes seventy-nine persons. The distribution of researchers and other staff members of the IA is plotted in the next figure.



Sixty scientific projects were developed in the IA over the period 2004-2008. These include 18 projects of the institute, 6 projects with the National Science Foundation, 3 projects sponsored by UNESCO-ROSTE, 1 project sponsored by NATO and 32 bilateral inter academic projects. The total number of scientific publications over the period 2004-2008 is **412**. Over the same period the total number of citations is **1056**. There are more than 80 papers per year published in the major European (*Astronomy & Astrophysics, Monthly Notices of the Royal Astronomical Society, Astron. Nachrichten, ApSS*), American (*Astrophysical Journal, Astronomical Journal, Publications of the Astronomical Society of the Pacific, Icarus*) and national (*Bulg. J. Phys., Bulg. Astr. J.)* journals for professional astronomy, as well as in conference proceedings.

In spite of the century-old tradition in training and preparation of qualified specialists and of the success recently achieved in the field of scientific research, observational, educational, qualifying, and popularizing activities, astronomy in Bulgaria experiences difficulties to keep the good specialists, mainly due to lack of funds for salaryes and for modernization and extension of the observational equipment. Even though recognized as a leader in the region, especially in the field of the spectroscopy and optical photometry, IA cannot hold yet its well-deserved position in the European family of astronomical observatories, remaining outside of the large-scale astronomical initiatives and structures like OPTICON, NEON, ESO. Like other East European countries, Bulgaria makes big efforts to stimulate its economy and to reform and modernise the existing scientific structures. However, the funds for science, provided by the government, are extremely insufficient; that is why our country faces real difficulties in the process of integration into the European Research Area.

Co-work with young people is one of the main activities stated in the strategic plan for the future development. By modernizing the observational facilities at NAO Rozhen, we aim to extend the range of astronomical projects, based on original observational data, and thus to make Astronomy more attractive for the young people in Bulgaria and in the region.

The Institute of Astronomy operates two observatories for optical astronomical observations: The National Astronomical Observatory „Rozhen“ (NAO-Rozhen) and The Belogradchik Astronomical Observatory (BAO), as well as the infrastructure needed for them.

2. The National Astronomical Observatory „Rozhen“

Rozhen National Astronomical Observatory (NAO) is in operation since 1980. It is located approximately 80 km southward from the second largest city in Bulgaria – Plovdiv in the Rhodopes mountains at 1750 m above sea level. Rozhen NAO comprises of four telescopes: universal 200 cm Ritchey-Chrétien-Coudé reflector, 50/70 cm Schmidt telescope, 60 cm Cassegrain telescope - all three made by Carl Zeiss factory, and 15 cm Lyot coronagraph. The 200 cm telescope has coudé and direct focuses, it is equipped with two liquid nitrogen cooled professional CCD cameras, UBVRI and interference filter sets, and two-channel focal reducer. Smaller telescopes are equipped with thermo-electric cooled CCD cameras and UBVRI filter sets.

The Observatory has been established as a highest level academic center for acquisition, analysis, archiving and disseminating of the scientific data. With its facilities and capabilities Rozhen NAO is the biggest astronomical complex in South-East Europe in the field of optical astronomy. The Observatory is included in the European Portal on Research Infrastructures Database (www.riportal.eu/). Due to the Ritchey-Chrétien optical layout the 200 cm telescope provides direct imaging of the sky with high spatial resolution (12.8 “/mm). Coudé spectrograph allows obtaining the high signal-to-noise, high resolution (up to 35000) stellar spectra. The most recent upgrade of the 2 meter telescope was accomplished in 2008, the main mirror and the first deflecting mirror to Coude were recoated with a new reflective layer. Presently activities are going on for the design, manufacturing and installation of a new telescope control system. The future plans incorporate design and manufacturing of an effective fiber-fed, bench mounted echelle spectrograph.

With its large field of view the Schmidt telescope is used mainly for studying small bodies in the Solar System. Many kinds of variable stars and objects have been observed with 60 cm Cassegrain telescope. Solar coronagraph with H-alpha filter is used to register the dynamic events in solar corona. Scanning microdensitometer MDM6 and Epson 10000XL scanner are available for digitizing the plate archive of the Observatory. Internal network structure contains about 30 workstations, two servers, several wireless hot spots,

and approximately 2 km of fibers. Computer class with ten computers, a conference hall with sixty seats and multimedia, twelve offices, some small apartments as well as hotel-like rooms for seventy persons are also accessible at the main Observatory building.

After almost thirty years of its functioning Rozhen NAO has already gained world-wide recognition as a valuable source of unique astronomical information. More than one thousand scientific papers, based on data obtained with the 200 cm telescope alone, have been published so far. They contribute substantially to many research fields of the contemporary astronomy – from physics of comets and asteroids, through stellar wind structure, anomalous abundance pattern of stellar atmospheres, tidal interactions and mass transfer in binary systems, through pulsating, flare and symbiotic stars, star-formation regions, stellar complexes and clusters in our Galaxy to the overall structure of near-by galaxies, and to active galactic nuclei and quasars. Rozhen NAO is a very suitable place to organizing scientific meetings, schools, professional training courses, and astronomical practices for university and high-school students from the country and all around South-East Europe. Few thousands tourists and visitors hang out at the Observatory every year. Small 18 cm Celestron is at their disposal to give them a fresh look at the skies during the summer nights.

3. The Belogradchik Astronomical Observatory

The Belogradchik Astronomical Observatory (BAO) was built in the period 1961 - 1965 and till 1974 was used as a satellite tracking station. In 1968 it was equipped with a 60cm Cassegrain telescope and in 1971 – with an UBV photoelectric photometer. After joining to the Department of Astronomy of BAS in 1976 it became full profesional astronomical unit. The altitude of the observatory is 610m and its coordinates are: longitude $1^h\,30^m\,41^s$ and latitude $43°37'\,22''$. During the years the o bservatory hosted many international meetings and schools of astronomy. In 1994 the observatory was equipped with a 36-cm Celestron telescope of Schmidt-Cassegrain type. Currently two main modes of multi-band observations are carried out regularly: photoelectric observations with a single channel photometer, and direct imaging with a CCD camera. For about ten years a SBIG ST8 CCD has been used, in 2008 the 60 cm telescope was equipped with a Finger Lakes Instruments research grade CCD, PL09000. The photometer uses GPS and its management is fully computerised. The data obtained are suitable for research in the fields of astrometry, astrophysics of some peculiar types variable stars and extragalactic objects. The observatory is open for student and tourist visits.

Annex II

Brief Description of the Department of Astronomy, St Kliment Ohridski University of Sofia (SU), http://www.phys.uni-sofia.bg/~astro

St Kliment Ohridski University of Sofia (http://www.uni-sofia.bg) is the largest and oldest (120 years old) institution of higher education in Bulgaria. It is also the second center for scientific research after Bulgarian Academy of Science.

Founded in 1894, the Astronomical Observatory and Department of Astronomy of the US is the oldest astronomical institution in Bulgaria from which emerge all new astronomical institutions like the Institute of Astronomy at the Bulgarian Academy. Up to date the Department is the only one responsible for the higher education of all three levels (BS, MSc and PhD) in the field of astronomy and astrophysics in Bulgaria. The annual graduation rate of students from the Department is: 5-10 BS, 5 MSc and 1 PhD. A significant number of our alumni further their education and/or find employnment in prestigious astronomical institutions worldwide.

At the disposal of the undergraduate students in the Department there are a number of small astronomical instruments: a historical 6" Grubb refractor, 14" CGE1400 Celestron equipped with SBIG STL-11000M large-format CCD camera and LHIRES III spectrograph with SBIG ST-1603 CCD camera, two old-fashioned 15 cm telescopes (Zeiss Meniskas and AT 150) and a Small Radio Telescope SRT. There are also a number of smaller 6 cm and 8 cm Zeiss refractors for visual observing. The graduate students are also using the observational facilities of the Institute of Astronomy.
At present the permanent staff of the Department numbers 15 professors, researchers and technical assistants. The majority of the staff is involved in various cutting-edge research projects at both national (mainly with the Institute of Astronomy and the National Astronomical Observatory) and international levels (e.g. Centre de Recherche Astrophysique de Lyon and Laboratoire d'Astrophysique de Grenoble, France, Armagh Observatory, UK, National University of Ireland, Galway, Zentrum fuer Astronomie Heidelberg, Germany, National Observatory of Athens and National and Kapodistrian University of Athens, Greece, Gemini South and the University of Valparaiso, Chile, John Hopkins University, USA). In the last five years as a result of the Department's research over 100 papers were published in high-impact scientific journals.

Besides the standard university educational programmes the Depatment effectively performs a number of additional educational activities. These activities are oriented to young astronomers, teachers-physicists and students from secondary and elementary schools. A number of undergraduate and postgraduate research projects are carried out in the Depatment lead by the staff or in collaboration with the staff of the Institute of Astronomy, the University of Shumen and the Public Astronomical Observatories and Planetaria. An example of such activity is the unique Beli Brezi Summer School (http://astro-brezi.org) held annually since 1970.

Astronomy courses for high-school teachers from all over the Bulgaria with talks on selected topics on modern Astronomy and Astrophysics are presented regularly in order to cover the National Educational Standards of the Bulgarian Ministry of Education and Science. The staff of the Department is developing a number of astronomical/astrophysical schoolbooks and resources and tools in Bulgarian for use by teachers and students in high schools in close collaboration with the teachers. Each year open days for schools to the facilities of the Department enable children from all over Bulgaria to get an insight in the work of professional astronomer and their instruments.

Annex III

Description of the Astronomical center, Konstantin Preslavsky University University of Shumen (ShU), www.shu-bg.net

Konstantin Preslavsky University of Shumen (Shumen university) is a national High school that provides education in a wide sphere of specialties in the field of Humanities, Natural, Technical and Social Sciences. It is founded almost 40 years ago.

Shumen University has the following specific characteristics.

- It is founded in a kind of town, that has a significant contributions in the education developing in Bulgaria, i.e. Shumen University is an University of Tradition.
- Shumen Univeristy is a member of the Association of the Classical Universities in Bulgaria
- Shumen University is an University of Tolerance because students of different ethnical groups study here
- Shumen University is a member of the European Association of Universities.
- Shumen University is being certified for the qualification education under the international system ISO 2000.

The Astronomical Center of ShU is founded in 1997 with 3 main responsibilities: (i) education of the students in astronomy; (ii) research in astronomy; (iii) popularization of the astronomy.

An astronomical dome with 3-m diameter was built in 1999 where 15-cm telescope **"**Meniskas" with astrocamera was set. Around the dome there is a platform for observation with small amateur telescopes (two 6-cm refractors, 6.5-cm reflector “Alkor”, visual tube and 6 sextants).

The Astronomical center of ShU has also 2 studies for the staff with a rich library and 6 computer configurations with a modern software as well as a laboratory for practical exercises with 10 computers, Schnell photometer, stellar maps, etc.

The academic staff of the Astronomical center of ShU consists of 1 full professors, 1 associate professor, 2 assistants, 1 PhD student.

The education in astronomy of students from the physical specialities in ShU has 25 years tradition. From the academic 2004/ 2005 year there is a specialty Astronomy, bachelors’ degree, in ShU. It got successfully accreditation in 2007 both in the distant form and the full timed form of education. The staff of the Astronomical center created several books for the students of the speciality Astronomy: Spherical Astronomy; History of Astronomy; Astrophysics; Variable Stars; Plasma Astrophysics, Planetary physics.

The staff of the Astronomical center realized also the education in Astronomy of the students in specialities: Physics; Geodesy; Biology & Physics.

The Astronomical center has the equipment required for the practical education in Astronomy. It makes the ShU the only University excepting the Sofia University which provides observational practice for students. Furthermore, under the agreement between the Institute of Astronomy of BAS and Shumen University, summer practice with professional telescopes of the students from the specialty Astronomy is realized at the National Astronomical Observatory-Rozhen.

The observational equipment of the Astronomical Center of ShU is used also for popularization work. Both observations and media press-conferences are organized for each significant astronomical event (eclipse, passage, and etc.).

The scientific investigations of the staff of the Astronomical Center of ShU in the area of variable stars (RS CVn stars, cataclysmic stars, eclipsing W UMa stars) have significant results and over 40 papers are published in the main European astronomical journals in astronomy. The staff of the Astronomical Center of ShU has taken part in the work of 5 international, 6 national and 6 regional scientific projects. Now they are partners in the 7 FP educational project “COSMOS” and are coordinator of the project “Student practice in astronomy” of the program of the EU “Development of the human resources”. They are also coordinator of the project „SMARTNET”: A Network of remote-controlled and robotic small

astronomical telescopes in Bulgaria" of the program "IDEAS" 2008 of the National Scientific Foundation of the Bulgarian Ministry of Education and Science.

Workshops for high-school teachers from all over the Bulgaria with talks and presentations on selected topics on modern Astronomy and Astrophysics are organized at different places of the country from the staff of the Astronomical Center of ShU in the framework of the project "COSMOS".

So, the Shumen University has a national and international recognition as a third center in Bulgaria for education and scientific research in astronomy (after the Institute of Astronomy of the Bulgarian Academy of Science and Sofia University).

Annex IV

CV, Tanyu Bonev
Institute of Astronomy at the Bulgarian Academy of Sciences

1978	graduated at the Physics Department, TU Dresden
1978 - 1984	night assistant in the National Astronomical Observatory, Bulgaria
1984 - 1989	research fellow at the Institute of Astronomy (IA), Bulgarian Academy of Sciences (BAS)
1989 - 1991	Max-Planck-fellowship at the Max-Planck-Institute for Aeronomy (MPAe), (today Max-Planck-Institute for Solar System Research) work on PhD thesis: "Fabry-Perot imaging of H_2O^+ in comets Brorsen-Metcalf and Austin"
1992	PhD thesis presented and defended at the Bulgarian Academy of Sciences.
1993 - 1997	Research fellow at IA, BAS
1997 - 1998	1 year Max-Planck fellowship, MPAe
1998 - 2008	senior research fellow at IA, BAS
since January 2008	director of the IA, BAS

Research activities:

- Observations of dust, neutral gases and ions in comets,
- Image processing, modeling of the dust distribution in comets
- Astronomical instrumentation - construction of a Focal Reducer for the 2-m telescope in the National Astronomical Observatory, Rozhen.

More than 70 scientific papers
More than 100 citations

Participation in several research projects with the National Science Fund in Bulgaria, PI in two of these projects.

Participation in international projects:
- European Programm for observations of comet Hale-Bopp.
- European Programm for ground based observations of comet Tempel 1 before and after Deep Impact.

Member of the International Astronomical Union.
Member of the European Astronomical Society
Member of the Society of Astronomers in Bulgaria

Annex V

CV, Valeri Golev
Department of Astronomy, Faculty of Physics, St. Kliment Ohridski University of Sofia

1975	graduated at the Sternberg Astronomical Institute, Moskow State University, former USSR
1975 - 1984	Supporting physicist at the Department of Astronomy
1984 - 1996	Assist. Prof. at the Department of Astronomy
1997 - 2009	Assoc. Prof. at the Department of Astronomy
1992	Visiting scientist at the Max-Planck-Institute for Aeronomy, Lindau, Germany (3 months).
1996	PhD thesis defended at the University of Sofia.
1998	Visiting scientist at the Centre de Recherche Astronomique de Lyon, France (1 year)
since 2003	Head of the Department of Astronomy

More than 90 scientific papers, more than 100 citations

Participation in several research projects with the National Science Fund in Bulgaria, PI in three of these projects.

Participation in international projects:
- COST Action 283 (national coordinator)
- Participation in three projects (one on-going) with CNRS, France

Member of the International Astronomical Union, Member of the European Astronomical Society, Member of the Astronomical Society of Bulgaria, Member and Vice-president of the Union of Physicists of Bulgaria

Annex VI

CV, Diana Kjurkchieva
Shumen University

1976	graduated at the Faculty of Physics, Sofia university
1977 - 1992	Assistant professor in Shumen university, Bulgaria
1985	Scientific degree PhD
1992 - 2005	Associate professor
2000 - 2002	Vice-rector of Shumen university
2003	Scientific degree Doctor of Science
2004-	Head of the Department of Physics of Shumen university
2005 -	Full professor
2004 -	President of Bulgarian Astronomical Society

Research activities:

- Observations of binary stars (chromospheric activity, cataclysmic binaries, contact W UMa stars
- Image processing, modeling of the binary stars
- Astronomical instrumentation – creation of a network of remote-controlled and robotic small astronomical telescopes in Bulgaria

More than 70 scientific papers
More than 100 citations

Participation in 4 research projects with the National Science Fund in Bulgaria

- Project No 144, National Scientific foundation (1987-1989), coordinator
- Project No 848, National Scientific foundation (1992-1994), coordinator
- Project No 634, National Scientific foundation (1997-1999), coordinator
- Project “SMARTNET: A Network of remote-controlled and robotic small astronomical telescopes in Bulgaria”, COMPETITION “IDEAS” 2008, coordinator

Participation in 5 international projects:

- European Project CEEPUS BG-2 (1994-1996), coordinator
- NATO project PST.CLG.978810/2002 (with Poland and Canada) “Determination of physical parameters of close binary stars”, partner
- European project TEMPUS SCM C016A05-20 (Macedonia, Italy), expert
- European project ECP-2006-EDU-410025 “COSMOS: An Advanced Scientific Repository for Science Teaching and Learning”, partner
- Project BG051PO001/07/3.3-01/0088 “Student practice in Astronomy”, European social foundation, coordinator

Member of the International Astronomical Union
Member of the European Astronomical Society
Member of the Society of Astronomers in Bulgaria