

## THE BELISSIMA PROJECT

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**Abstract.** We present the BELISSIMA project, the most ambitious infrastructural project currently active at the Astronomical Observatory of Belgrade, its goals and achievements. The importance of the project for the future of the astronomy in Serbia will also be addressed.

### 1. INTRODUCTION

BELISSIMA (BELgrade Initiative for Space Science, Instrumentation and Modelling in Astrophysics) is the three-year FP7 REGPOT project started in July 2010. The project is coordinated by the Astronomical Observatory of Belgrade (AOB) and is its most ambitious infrastructural project currently active. The project was evaluated very favourably by the European Commission and obtained 14.50 out of 15.00 points; its “scientific and/or technological excellence” was highly regarded and BELISSIMA obtained maximal 5.00 points. The approval of the project was thus explained: “The BELISSIMA is an excellent project which is perfectly targeted and very clearly described. (...) The proposal to upgrade the research capacity of the AOB is based on the excellent competence and research activities which are on the cutting-edge of astrophysics and astronomy“.

The BELISSIMA project consists of five work packages (WPs) which are listed below with their leaders. The Management board of BELISSIMA consists of the leaders of the WPs given below and the coordinator of the project is Srdjan Samurović. The WPs (and their leaders) are:

1. Preparations and reinforcement of AOB (leader: Zoran Knežević)
2. Purchase, installation and testing of optical equipment (leader: Ištvan Vince)
3. Human potential, training and public outreach (leader from March 2011: Miroslav Mičić; from July 2010 to March 2011 the leader was Luka Č. Popović)
4. Dissemination and promotional activities (leader: Milan Ćirković)
5. Project management (leader: Srdjan Samurović)

## 2. GOALS AND ACHIEVEMENTS

The most important goals and achievements of each WP of the BELISSIMA project are presented below.

### 2. 1. WP1. PREPARATIONS AND REINFORCEMENT OF AOB

From the very beginning of the BELISSIMA project, the procedure for increasing and improving human resources of the AOB took place in parallel with activities performed in other WPs. The Management board of the BELISSIMA project started from the beginning of 2010 (as soon as the positive outcome of the proposal was announced) to intensify the contacts with candidates for a total of 72 months of engagement intended for recruited researchers. This task, which required a significant knowledge of the local legal procedures, was successfully handled by Director of AOB, Zoran Knežević, the head of WP1.

The first researcher, Milan Bogosavljević was hired on July 15th, 2010. Milan Bogosavljević was born in Niš in 1977. He graduated from the University of Belgrade, Faculty of Mathematics, Serbia and obtained his PhD from California Institute of Technology (CalTech). He is an expert in observational astronomy with a significant experience with observations with the world's largest telescopes (such as Keck). Immediately after his hiring M. Bogosavljević was appointed technical director of the Vidojevica Astronomical Station (VAS) and initiated his numerous activities which included several trips abroad and contacts with foreign experts related to the design and construction of the planned telescope "Milanković" to be mounted at the VAS.

The second researcher, Miroslav Mičić was hired on March 16th, 2011. Miroslav Mičić was born in Belgrade in 1977. He graduated from the University of Belgrade, Faculty of Mathematics, Serbia and obtained his PhD from the Pennsylvania State University. He joined the BELISSIMA project coming from the University of Sydney where he had been working. He is an expert in astrophysical simulations, astronomical data processing and visualization of astronomical data and his activities include several research projects with young researchers at the AOB based on numerical astrophysical simulations; he was appointed leader of WP3 of the BELISSIMA project.

Soon after the international BELISSIMA conference, on November 1, 2012, the third researcher was hired within the scope of WP1: Milica Mičić, born in Kruševac in 1984, graduated from the Department of Mathematics at the University of Belgrade in June 2008 and later, in December 2008, also obtained the masters degree there. She obtained her PhD at the Institute for Theoretical Astrophysics at the University of Heidelberg (Germany). Milica Mičić is an expert in numerical astrophysical simulations in the field of massive star and molecular cloud formation, focusing on the influence of chemical processes on the gas dynamics and is also an expert in astronomical data processing and visualization of astronomical data.

At present all three hired researchers are fully integrated in the AOB environment and participate in the work of the project no. 176021, "Visible and Invisible Matter in Nearby Galaxies: Theory and Observations", led by a coordinator of BELISSIMA, S. Samurović and funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia. They will be offered permanent positions at the AOB after the end of the BELISSIMA project in July 2013.

2. 2. WP2. PURCHASE, INSTALLATION AND TESTING OF OPTICAL EQUIPMENT

From the beginning of BELISSIMA the Management board of the project began to work on the selection of the optimal configuration of the robotic 1.50m-class telescope to be purchased and mounted at the top of Vidojevica. The telescope will be named “Milanković” after the famous Serbian astronomer. Several manufacturers of telescopes were contacted and they provided their estimates of prices. The additional funds for the purchase and the building of the dome are obtained from the Ministry of Education, Science and Technological Development of the Republic of Serbia through the aforementioned national project no. 176021 that gathered 26 researchers from leading research institutions of Serbia. Their agency JUP (Jedinica za upravljanje projektom, Project Implementation Unit) was authorized by the AOB to perform the tender procedure on its behalf. At the time of this writing (May 2013) the negotiations with the manufacturers were finished, the details of the contract for the purchase of the 1.50-m class robotic telescope “Milanković” are established and it is expected that it will be signed before July 2013. In order to prepare the accurate documentation and to secure the best performance of the future telescope, numerous contacts with foreign experts were made (see also below).

2. 3. WP3. HUMAN POTENTIAL, TRAINING AND PUBLIC OUTREACH

Throughout the whole duration of the BELISSIMA project numerous activities pertaining to human potential, training and public outreach were performed and below only the brief list is given. The reader is referred to the BELISSIMA Web site (see below) for the detailed information.

At the beginning of the project two events were organized. First, on September, 6th 2010 at the AOB the meeting of the Serbian astronomical community was organized and 40 colleagues from the AOB, Department of Astronomy (Belgrade University), Institute of Physics (Belgrade) and People’s Observatory from Belgrade took part in the discussions related to the needs of the community regarding the new telescope. The second event was organized three weeks later: the executive meeting of the BELISSIMA project took place in Prokuplje, from 27th to 28th September 2010. The meeting “Network of Telescopes in the Western Balkans Region” gathered 30 participants, of which 13 were foreign experts from several European countries.

Numerous visits to various European observatories and institutes were organized: Orliakas Astronomy Station in August 2010; meeting “Big Science With Small Telescopes” held in Dornburg, near Jena, Germany, from October, 19th to 22nd 2010; observations at the Baja Observatory, Hungary (February 2011), visit to the telescopes at Tenerife and La Palma (February/March 2011); “Second Workshop on Robotic Autonomous Observatories” held in Malaga, Spain from 5th to 10th June 2011; “Hands-on Strong Gravitational Lensing School” held at Excellence Cluster Universe, Garching, Germany from 14th to 17th June 2011; summer school “Opto-Mechanical Design in Astronomy” which was held at the Astrophysical Institute of Potsdam (AIP) in Potsdam, Germany from June 20th to 23rd, 2011; the observing NEON school held at Molitai Astronomical Observatory (Lithuania) from July 14th to 27th, 2011.

Two long-term (six months in total) visits of the members of the AOB staff were organized in collaboration with the Leibniz Institute for Astrophysics (AIP) in Potsdam, Germany. First, Monika Jurković visited the AIP from April to June 2012

for the purpose of training with the new instruments to be put on the "Milanković" telescope to be purchased through the BELISSIMA project and the techniques of observations to be performed with it. She participated in the work of the Stellar Activity research group at the AIP. The main aim of her project was to derive stellar parameters like effective temperature, gravity and metallicity from the database of the STELLA robotic telescopes, which are located on Tenerife. The second researcher who visited the AIP was Milena Jovanović: she visited the AIP from June to August 2012 where she joined the Stellar Activity group and in particular the part of it connected to the STELLA project. STELLA is an observatory hosting two robotic 1.2 m telescopes (STELLA-I and STELLA-II) that operate in fully unattended mode (see the contribution of the STELLA project manager M. Weber, who supervised the two visits, in these Proceedings).

Also, foreign researchers came to the AOB after the invitation of the BELISSIMA project: Zach Ioannou (presently at the Sultan Qaboos University, Oman, see his contribution in these Proceedings) came from Thessaloniki to Belgrade where he stayed from March 28th to April 2nd 2011. Z. Ioannou is one of the creators of the Astronomical Station Orliakas. He came for two reasons: to help with the writing of the technical documentation regarding the construction and purchasing of the telescope "Milanković" (see above) and scientific collaboration with AOB. Although his advices were mostly technical ones (parameters of the various parts of the telescope, details of the construction etc.) he also provided the participants of BELISSIMA numerous administrative details regarding European tenders.

For the purpose of training of the AOB staff various activities were performed, such as: training at the VAS, training course related to photometry and spectroscopy held at AOB in May 2011 by Ištvan Vince and data reduction training at the AOB.

One of the main dissemination activities of the BELISSIMA project (see also below) was the production of a series of TV programmes aimed at a wide non-expert audience but since some such activities belong to WP3 we present them in this subsection. So far (May 2013) four TV episodes were shot and edited, whereas the remaining two will be finished by the end of BELISSIMA. The first episode is mainly dedicated to the VAS, the second episodes shows the AOB, its activities and projects and is focused on the 125th anniversary of one of Serbia's oldest and most successful scientific institutes. The third and fourth episodes are dedicated to the international BELISSIMA conference held in Belgrade in September 2012 and many of the speakers took part and presented their work. These two episodes will be subtitled in both Serbian and English in order to reach the widest possible audience. Before the end of BELISSIMA the production of the multimedia DVD aimed at the local lay audience is planned: the disk will include various video materials, audio recordings and photographs accompanied with the written information.

#### 2. 4. WP4. DISSEMINATION AND PROMOTIONAL ACTIVITIES

Since one of the requirements of FP7 projects is communication, dissemination and exploitation of the results of the project, the Management board of BELISSIMA engaged with the public and with the media on numerous occasions to discuss the project, its accomplishments, its activities and the plans for the future. Here only a few dissemination and promotional activities are listed (the production of the BELISSIMA TV programme and multimedia DVD was addressed above, when the activi-

ties done within WP3 were described): the all-sky camera at the VAS recorded on November 12th, 2010 is (to the best of our knowledge) the only image of the meteor entering the atmosphere above Serbia and numerous media have published it thus promoting the BELISSIMA project, the VAS and AOB in public; AOB had the honor on November, 8th 2010 to host Prof. Sir Arnold Wolfendale, FRS, 14th Astronomer Royal and the participants of the BELISSIMA project discussed with him numerous issues; BELISSIMA has participated in the 4th Festival of Science held in Belgrade in December 2010; an article which describes the BELISSIMA project and telescope “Milanković” were published in the illustrated Serbian almanac “Danica” (Samurović 2011, 2012a, 2013); several BELISSIMA participants took part in various radio and TV programmes; the cooperation with Amateur Astronomers Association of Serbia has started from the very beginning of the work of the BELISSIMA project; the BELISSIMA project collaborated with the researchers from Serbian town of Niš through various initiatives – we mention here only one: Goran Sv. Djordjević who leads Southeastern European Network in Mathematical and Theoretical Physics organized a seminar “Trends in Modern Physics” for the elementary and high school teachers from Balkan countries and neighboring regions, held in August, 2011 in Niš and in agreement with the BELISSIMA project the teachers were taken to the VAS and the first TV material related to BELISSIMA was shot there (see above); several BELISSIMA participants took part in the activities of the Research Center in Petnica. The AOB brochure dedicated to the AOB, its history, its present activity and its future which will be marked by the “Milanković” telescope was published in December 2011. The booklet printed in two versions (Serbian and English) is in an accessible language and presents active projects, their leaders and participants. A special attention was given to the BELISSIMA project which is covered in detail. The first BELISSIMA Workshop was organized from 13 to 14 October 2011, after the 16th National Conference of Astronomers of Serbia: it gathered approximately 50 participants out of which 21 were foreign experts who discussed with the BELISSIMA participants various aspects of observations possible with 1.50 m-class telescope, the CDROM with the contributions was printed. The second BELISSIMA Workshop is scheduled for the spring of 2013 when the local astronomical community will discuss the feasible projects with the “Milanković” telescope. The international BELISSIMA conference, “Future Science With Metre-Class Telescope” was held in Belgrade in September 2012 and approximately 100 participants took part in it and the present Proceedings books will serve as a useful source of information for the observing projects which will use the “Milanković” telescope. Whenever possible the participants of BELISSIMA took part in various initiatives to promote the project and the activities of the AOB. Here we mention AIS<sup>3</sup> (Association of Italian and Serbian Scientists and Scholars) organized by Paolo Battinelli, astronomer from Rome, presently attaché for science with the Italian embassy (see his contribution in these Proceedings): both the AOB and BELISSIMA were presented at the AIS<sup>3</sup> Workshop “Serbia-Italia: Status and Perspectives of Scientific and Technological Bilateral Cooperation”, held in June 2012 in Belgrade (Samurović & Knežević 2013). We also mention the presentation of the BELISSIMA project at the 16th National Conference of the Astronomers of Serbia held in October 2011 (see Samurović 2012b).

## 2. 5. WP5. PROJECT MANAGEMENT

The project management of the BELISSIMA project was done by the Management board of the project and coordinated by S. Samurović. The Management board includes all the leaders of WPs (as given above) and had meetings on a regular basis when the activities of the project were discussed and the tasks for a future work were created.

## 3. CONCLUSIONS

In this contribution the most important facts regarding the BELISSIMA projects and its activities were presented.

The BELISSIMA project proved to be important for Serbian science. It created favourable conditions for the return of Serbian researchers working abroad and three astronomers initiated their professional careers at the AOB. By constructing the “Milanković” telescope Serbia is opening doors to the new technologies in the field of optics, astronomy, informatics, and electronics. The BELISSIMA project played an important role in improving scientific literacy in Serbia and its products (such as TV programs, these Proceedings, the AOB brochure, etc) are expected to provide useful information to the professional community and interested public. The hiring of three experienced researchers at the AOB will intensify the research efforts performed at one of Serbia’s most distinguished research institutes. BELISSIMA strengthened and established new regional collaborations with partners from the Western Balkans and with the leading European scientific institutions. The BELISSIMA WWW site is at <http://belissima.aob.rs> and will remain active after the end of the project (July 2013) providing information and multimedia content.

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