

**OBSERVATIONAL ASTRONOMY  
AT PETNICA SCIENCE CENTER**

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**Abstract.** During years 2012 and 2013, Petnica Science Center has been undergoing a thorough renovation and expansion. One of the new features will be new observational equipment intended for high-level educational work at the Department of astronomy. In this short paper we sum up main observational activities at Petnica Science Center, and discuss desired observational equipment.

## 1. INTRODUCTION

Petnica Science center (PSC) is an educational facility, intended primary for high-school students interested in science. Educational work is done through fifteen departments which cover most of modern science disciplines. The departments organize several seminars for students, on a yearly basis. The main goal of these events is to introduce participants to the modern science and to give them opportunity to: i) attend advanced lectures which are far beyond the scope of school curriculum; ii) do their own research in the desired field, while having equipment unavailable to their schools and collaborating with professional scientists.

The department of astronomy exists in Petnica Science center since its beginning. The majority of Serbian professional astronomers participated in the seminar as students, lecturers, research mentors, heads of the department, or sometimes, all four of those. Special attention is paid to the independent research projects of astronomy

students. After their first year of attending the seminar, the whole second year is dedicated to students' research. They attend total of four seminars during the second year:

- Winter school: 4-5 day seminar with focus on modern research subjects in astronomy and astrophysics which are adaptable to the level of the advanced high school students. Professional astronomers are invited to give short lectures on their research topics and propose interesting research themes for students. If there are participants interested in the topic, the astronomer is appointed as a mentor, along with one or two junior associates which mediate and help the student with essential tools and the literature.
- Spring workshop: 3-4 day seminar where project proposals and preliminary investigations are performed with the mentors and junior associates. Also, small workshops on various topics are organized (e.g., numerical computing, astronomical image processing, data mining...).
- Summer school: two-week seminar, completely dedicated to the work on the project. Students are given complete freedom in managing their free time, they have access to observational and computing equipment under the supervision of junior associates and access to library and on-line resources.
- Autumn seminar: 4-5 day seminar where results of the research are transcribed, discussed and considered for the annual conference of Petnica students. Several short presentations of possible research topics for the following year are presented.

## 2. OBSERVATIONAL PROJECTS

Vast majority of research projects are either observational or computational with ratio which varies through years. Observational projects are chosen so that the observations can be done in relatively short period of time (week or two; in special cases, more observations during the year can be done). It is very important for the student to go, if possible, through all the stages of an observational research:

- Planning observing schedule and appropriate equipment (CCD camera, 35mm camera, adequate filters, etc..).
- Actually performing the observation, handling the telescope and the camera.
- Reducing observations.
- Discussing observations and inferring object physical properties.

During last ten years most projects were done on MEADE 178ED apochromat telescope mounted on Paramount ME robotic mount. SBIG ST-6 and ST-7 CCD camera were used, along with a filter wheel with UVBRcIc set of filters. Thanks to an excellent collaboration between PSC and the Astronomical Observatory from Belgrade (AOB), another CCD camera, SBIG ST-8 was sometimes available, and some observations were done at the telescopes belonging to AOB. Some of the research topics studied over the last ten years were:

- Multi-band photometry of close binary systems: Several short-period systems have been observed, complete image reduction and aperture photometry have been done, and astrophysical inversion has been performed with the help of researchers from AOB.
- Observation of exoplanet transits: Even with a small-aperture telescopes such as this one, transits of some exoplanets were detected from Petnica (most recently, TRES-3B) and rough estimation of planetary parameters was done.
- O-C analysis of binary systems with estimation of mass transfer and/or presence of the third body.
- Photometry of short period variable stars.
- Photometric observations of asteroids and determination of the asteroid shape from the light curve.
- Study of atmospheric extinction and light pollution over PSC.

Most of these research projects were presented at the annual conference of Petnica Science center students and later published in the proceedings of the conference. Conference follows the style of professional scientific conference, projects are presented as posters or oral presentations, papers are submitted for publishing afterwards and thoroughly reviewed prior to publishing. Proceedings of the conference as published by PSC, each year and sent to all collaborating institutions in the country and abroad. Papers are also available on-line (<http://prs.petnica.rs/eps>).

### **3. NEW EQUIPMENT**

In years 2012/2013, PSC has undergone a major expansion, both in the terms of the infrastructure and in the terms of obtaining the new equipment. Having in mind interests of the astronomy students and desired expansion of possible research ideas, we plan to obtain the following equipment:

- A 60 cm reflector telescope with a robotic mount and an “out of the box” dome.
- One smaller ( $\approx 15$  cm) telescope which can be mounted on the same robotic mount or de-attached and used with mobile robotic mount
- 2 CCD cameras intended mainly for photometric observations. We aim for fast, high-resolution ( $>2$ MP), high quantum efficiency cameras, with several sets of high quality wide- and narrow-band filters
- One high-quality digital camera (e.g. Cannon EOS 5 MK II) with appropriate adapters, intended for astrophotography.

Our main requirements for the telescope are wide field of view, ease of use and as low maintenance costs as possible. We plan to obtain CCD cameras and filter sets which are of good enough quality which will enable us to perform high-precision photometric observations so our telescope can be put at the disposal of researchers from AOB and other professional astronomical institutions in the country or even

from abroad. Even though observing conditions in Petnica are far from perfect, average seeing being around  $2.5''$ , we see this as a possibility since Petnica is also relatively close to Belgrade ( $\approx 100$  km). Also, we would like to extend research fields of our students to other topics such as: photometry of globular and open clusters, photometry of asteroids, exoplanet monitoring, etc. We plan to have at least some of the equipment ready for use in the summer of 2014. It is also our desire to collaborate more tightly with other departments from PSC so that some of our equipment, such as CCD cameras, can be put to use by students attending other seminars as well.

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