

Name of research institute or organization:

Center for Space and Habitability (CSH), University of Bern (UoB)

Title of project:

Stellarium Gornergrat

Project leader and team:

Dr. Timm-Emanuel Riesen, project manager
Dr. Marco Longhitano, lead developer of pedagogical materials
Prof. Dr. Kathrin Altwegg, steering committee
Prof. Dr. Thomas Schildknecht, steering committee
For a complete list of team and associates, please see related webpages

Project description:

The Stellarium Gornergrat is a long-term project carried out by an on-going collaboration between the Center of Space and Habitability (CSH), the Astronomical Institute (AIUB) of the University of Bern, the University of Geneva (UoG), and the International Foundation High Altitude Research Stations Jungfrauoch and Gornergrat (HFSJG). Its major focus lies with public outreach and education. The project's main goals are:

- To build bridges between science and society.
- To spark and foster the public's interest in space, space sciences, and astronomy.
- Attract young people to the field and illustrate potential careers in astronomy and space sciences.
- Help people recognize and understand different observable phenomena in the day and night sky and let them appreciate the beauty and delicacy of nature.

In order to achieve these goals, the partners installed and operate an observatory at the Kulmhotel Gornergrat with different instruments and hardware (see Figure 1). Improvements are still in progress and the infrastructure will be renovated in the years to come. At the end of 2015, 6 different instruments were installed and operable:

1. Allsky Camera, takes around the clock exposures of the complete day and night sky.
2. Rila 600mm telescope with a huge Field of View (FOV) ideal for deep sky objects.
3. Planet Camera (Takahashi Mewlon-250), ideal for planetary objects and small FOV.
4. Constellation Camera, ideal to depict complete constellations, asterisms, and group of constellations.
5. Look-through Telescope (Takahashi TAO-150) for guests at the location.
6. A modified Celestron 8 telescope with prism to measure the astronomical seeing.

The main mode of using the Stellarium is designed to be by remote control and robotic observing which will be enabled through a pedagogical web portal, where teachers, students, and the broad public are allowed to browse and pick among different astronomical activities and schedule observations. The Stellarium robotically works through the different scheduled observations and allows a registered user to access the obtained data or status information upon completion of a task.

The pedagogical activities are currently being developed in German and French in 4 different levels of difficulty ranging from 4th grade primary school to first year university students. Among the project's personnel are scientists and teachers that ensure that the activities are in high quality with regard to astronomical content and feasibility for teachers and schools. All activities are scientifically and pedagogically peer reviewed and tested in class.



Figure 1. Available instruments at the Stellarium Gornergrat: The left panel shows the RILA main instrument (black), the Takahashi Mewlon-250 Planet Camera (blue-white), the Takahashi TAO-150 Look-Through Telescope (red-white), and the C8 Seeing Telescope. The upper right panel shows the Allsky camera and the lower right panel shows the Canon 60Da Constellation Camera.

Achievements in 2015:

Hardware:

No new instruments were added during this reporting period, but improvements and additional features were added to the existing instruments. The Mewlon 250 (Planet Camera) was augmented with a fully remotely operable focuser, which interfaces to the main control software. The Canon 60Da (Constellation Camera) will receive a highly customized housing that will allow setting the zoom factor of an installed lens remotely and unattended. Work is in progress and should be finished in Q1 2016. The Allsky Camera was removed and brought to Bern in fall 2015 for complete maintenance as condensation was starting to be an issue in early fall. The design has been considerably improved: The camera housing received a complete new bottom latch that amends the rather wanting design (by manufacturer) where screws were not applying pressure in direction of the sealing O-ring. This is no longer the case now. Also, proper UV resistant glass was used to seal the window in front of the light sensor. The original plastic part was eroded and punctured by the strong UV light. Other optimizations for easier maintenance have been made as well, and all silica gel pads were replaced. The manufacturer was very interested in our improvements: in turn for sharing our upgrades, we negotiated a software update with some new functionality as e.g. automated star counting, with counts being stored in the FITS header. Finally, a new professional inclinometer has been ordered and will be installed in Q1 2016. It will allow tracking the movements of the hotel and dome at very high accuracy and help improving our pointing and mount models.

Software and web-portal:

Many new features have been added to the control software and for the first time, we tested completely autonomous observing. The main effort this year went into programming the web portal, where substantial milestones have been reached. In January 2016, we are now one last

development step away from reaching our first release version. Initial tests with booking activities from inside the portal and executing the corresponding observing tasks at the Gornergrat were completed successfully. Data transfer back to Bern has been problematic due to connection problems between our computers at the summit and Zermatt. They are currently being addressed.

Personnel and other:

Prof. Stéphane Udry, University of Geneva joined the steering committee. Barbara Muntwyler can no longer support us in house due to higher teaching loads, but is still included in peer review processes via her school.

A very substantial milestone has been reached on July 3rd 2015 in Zermatt: Our Memorandum of Understanding (MoU) has been signed by the Burgergemeinde and the HFSJG, finalizing the document with these last two signatures. We are very happy to have this great project on safe grounds now, with all main actors and partners on board.

Pedagogical Activities:

In this reporting period we were working on various activities and did good progress. The first finalized documents (worksheets of the Galaxy-zoo activity) were used in class and we received positive feedback from the teachers and students. We finalized all documents of the German version of the Galaxy-zoo activity. The same activity was also used for implementation and testing of the web-portal and the teacher training that took place at the end of October (see below). An external translator has translated the activity to French. We are still in the process of reviewing the work, but it seems that the quality of the translation does not meet our requirements. After the technical review we will decide how to proceed with the current and future translations.

Currently, the following activities are under review:

- Rotation period of Jupiter
- Earth's rotation
- Moon illusion
- Galilean moons

The review process is comprehensive, as content and layout need to be related and aligned to other activities and to our development guidelines. While such an elaborated approach obviously takes more time, it results in high quality documents. The feedback of various teachers confirms our view that well thought-out and carefully implemented activities make the difference.

Stéphane Gschwind has been working in collaboration with Marco Longhitano in the review process. Both also worked in collaboration with Sylvia Ekström (Observatory of Geneva, Unige) for the presentation of our project at the Scope Days (national Scientix meeting on out of school learning, in Geneva 10 & 11 November, <http://scopedays.ch>). Gwschind continued to promote our project to physics teacher students with a presentation of our project at the IUFÉ (Institut Universitaire de Formation des Enseignants at the Unige).

Matias Etter has completed his Master thesis at the PH Bern on Galilei's observations. In the context of his thesis he developed an activity on the Galilean moons, which is currently under review as well.

Eugenio Alba is a secondary school teacher and currently doing his sabbatical with the pedagogical team. He is developing a new activity that aims at the determination of the Age of the Crab Nebula.

Related projects involving schools:

The high school thesis (Matura) of Flavia Heule at the Kantonsschule Heerbrugg (SG) on the distance determination of galaxies using Cepheids has been successfully completed. It can be

seen as a proof of concept of the feasibility of an activity about this topic using the instrumentation of the Gornergrat observatory.

In November we supported a one-week specialist course at the Kantonsschule. Three projects were offered: Determination of the rotation period of Jupiter, orbit determination of asteroids, and distance estimation of the Andromeda galaxy using Cepheids. For all projects, raw data from Gornergrat has been provided that has not been analysed before, while the task was formulated in an open way without giving detailed instructions. The students were very enthusiastic about the projects mastering most of the challenges by their own. Also the teachers were thrilled emphasizing two things: First, they would not have dared to choose astronomy as a topic for the specialist course without the offer from the Stellarium Gornergrat project. Second, it would not have been possible to realize the course without the on-site support of the Stellarium Gornergrat team.

Teacher training:

An important milestone of the project was the teacher training that took place in Bern at the end of October. The training gave an overview of the project as a whole and then turned to a hands-on presentation of the Galaxy-zoo activity. The feedback of the teachers was very good. Several teachers were already participants at the first teacher training that took place in Bern in March 2014. This shows that our project generates a great interest among teachers and that those interests grow as do our activities. They particularly liked our application-oriented, hands-on approach. Several teachers emphasized that, unlike other trainings, they received very practical instructions and that they can use our elaborated teaching material in their classes right away. This encourages us in our approach to develop elaborated activities with detailed suggestions of how to put them into school practice based on modern, constructivist learning theories and experience from in-class tests.



Figure 2. Impression of the teacher's training in October 2015. The workshop was very successful and well attended.

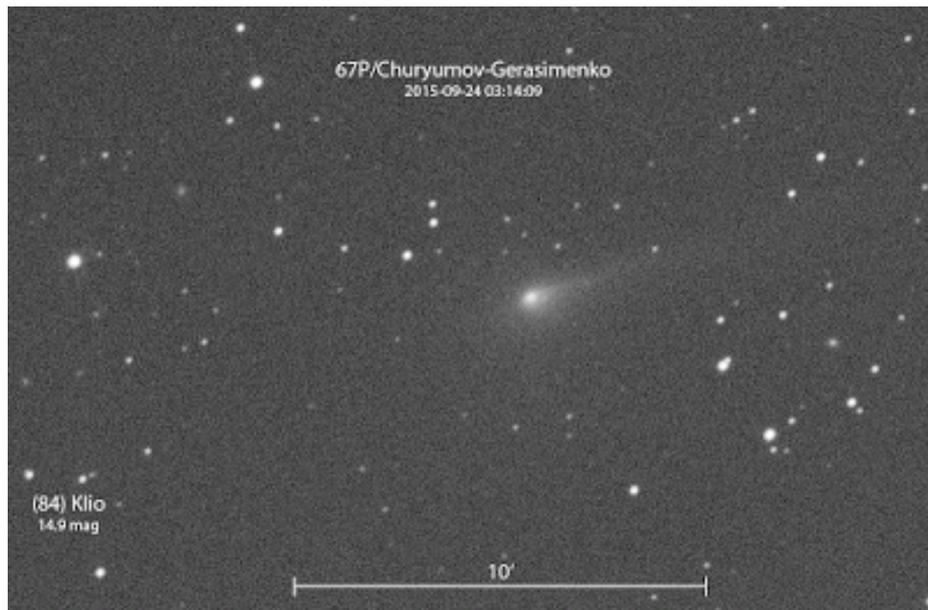


Figure 3. Comet 67P/Churyumov-Gerasimenko, the target body of ROSINA-Rosetta, as seen with the Stellarium Gornergrat in September 2015. Comet coma and tail are clearly visible while the nucleus is hidden due to the increased activity (Perihelion was in August 2015). On the left side on the same frame is G-type asteroid (84) Klio, which was discovered quite early in 1865 by the German astronomer Karl Theodor Robert Luther.

Key words:

Stellarium, Gornergrat, Astronomy, Outreach, Robotic Observing, Pedagogical Activity, Telescope, School, Education

Collaborating partners/networks:

Astronomical Institute of the University of Bern (AIUB)
Université de Genève (UoG)
Burggemeinde Zermatt
International Foundation High Altitude Research Stations Jungfrauoch and Gornergrat (HFSJG)
Kulmhotel Gornergrat

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