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
Prof. Dr. Kathrin Altwegg, steering committee
Prof. Dr. Thomas Schildknecht, steering committee
Prof. Dr. Kevin Heng, steering committee (director of the CSH)
For a complete list of team members and associates, please see related webpages (URL provided at the end of the report)

Project description:

The Stellarium Gornergrat is a long-term project carried out by an on-going collaboration between the Center for Space and Habitability (CSH), the Astronomical Institute (AIUB), the University of Geneva (UoG), and the International Foundation High Altitude Research Stations Jungfraujoch 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.

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 2017, five different instruments were installed and operable:

1. The Allsky Camera, takes around the clock exposures of the entire day and night sky.
2. The RiFast 600mm telescope with a huge Field of View (FOV) is ideal for deep sky objects. This telescope replaces the Rila 600mm telescope that was installed before.
3. The Planet Camera (Takahashi Mewlon-250) is ideal for planetary objects and small targets that require a small FOV.
4. The Constellation Camera is ideal to depict complete constellations, asterisms, and group of constellations.
5. The Look-through Telescope (Takahashi TAO-150) for local guests and guided tours at the observatory.

A major way to use the Stellarium Gornergrat is by scheduling observations remotely through a web portal that triggers robotic observing. Teachers, students, and the broad public can browse and pick among different astronomical activities and schedule observations. The Stellarium automatically works through the different scheduled observations and allows a registered user to access the obtained data or status information upon completion of an observation task.

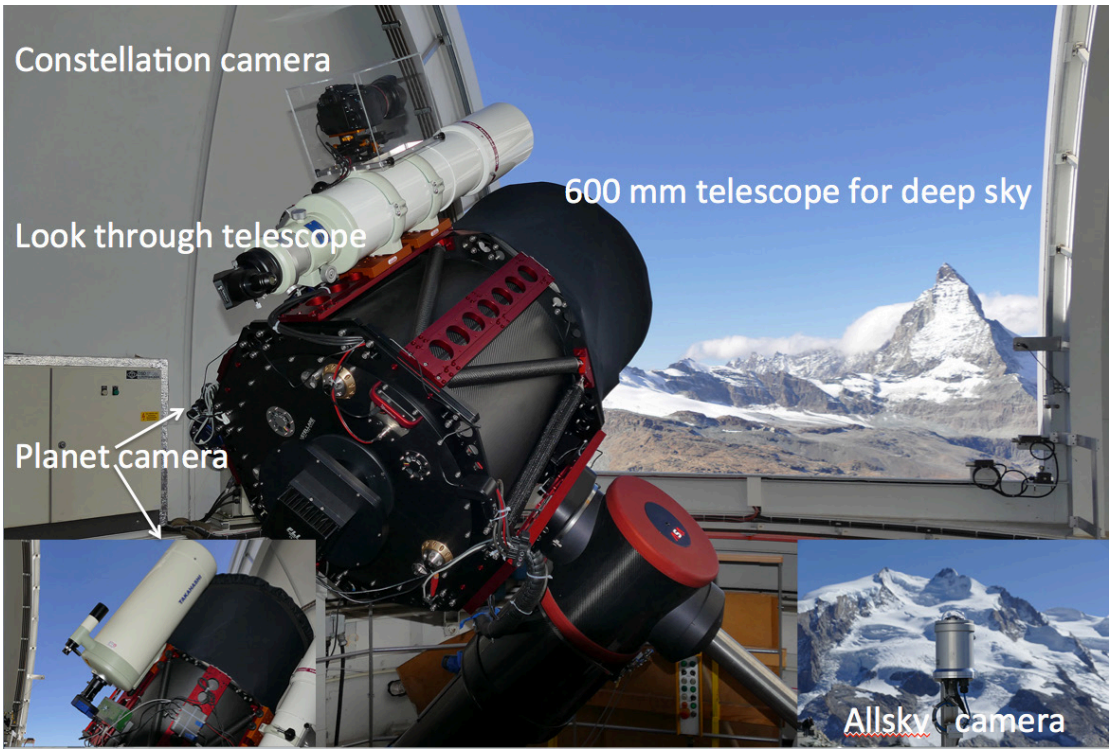

Figure 1. Available instruments at the Stellarium Gornergrat: On the ASA DDM 160 mount inside the south dome are the Officina Stellare RiFast 600mm "Deep sky telescope", the Canon 60Da "Constellation camera", the Takahashi TAO-150 "Look-through telescope", and the Takahashi Mewlon-250 "Planet Camera"(see image inset in the lower left). Mounted on a boom outside the north dome is the Alcor systems "Allsky camera" with a DMK51AG02.AS CCD sensor (see image inset in the lower right).

Achievements in 2017:

General:

- In 2017 the Stellarium Gornergrat switched the last parts of the project from initial building and testing phases over to full operation. While the entire local activities as e.g. the "Dining with the stars", guided tours, etc., were successfully launched and repeated in preceding years, a first version of the web portal, being the last missing piece, became operational in June 2017. With it, the core functionality was designed; the possibility for teachers and students to schedule observation tasks that are performed automatically became reality. Since then hundreds of users have joined the project and the initial feedback is very positive.

Hardware:

- In early 2017, during phases of cold temperatures below -15° C, we encountered errors while attempting to move the mount around the RA axis. During a complete disassembly of the telescope in March, the top part of the mount was removed to allow the replacement of a circuit board, which could be responsible for the problems encountered. After this work was completed, temperatures were not low enough to test if the problem was solved or not.
- On March 13th, the Rila 600 main telescope was replaced with its successor, the RiFast 600 from Officina Stellare (see Figure 2). This major change in instrumentation resulted in a large increase of imaging quality as several issues present in the predecessor have been remedied (see Figure 3). The stability of the main mirror and its independence on telescope attitude has been improved dramatically with a complete new design. The baffle was optimized to eliminate effects from irradiating light of bright stars that were some degrees off the field of

view but close enough to the optical axis of the system. Some of these improvements were stimulated by our reporting and in direct communication between Stellarium Gornergrat staff and specialists at Officina Stellare, after carefully documenting the issues in previous years.

- A new combined power supply for all the different devices on the mount has been custom-tailored by a member of the University of Bern electronics workshop (C. Josi) and was installed during the telescope replacement. A major re-cabling effort was done at the same time.

Figure 2. Upper left image: The new telescope arrives by helicopter and is received by members of the Stellarium Gornergrat crew. Lower image: Unboxing of the new Officina Stellare RiFast 600 telescope by B. Hiltbrunner (left), T. Riesen (right), and P. Schlatter (behind the camera). Upper right image: Complete disassembly of the existing instrumentation and part of the mount in March 2017. An electronic circuit board inside the ASA DDM 160 mount was replaced in the same maintenance window.

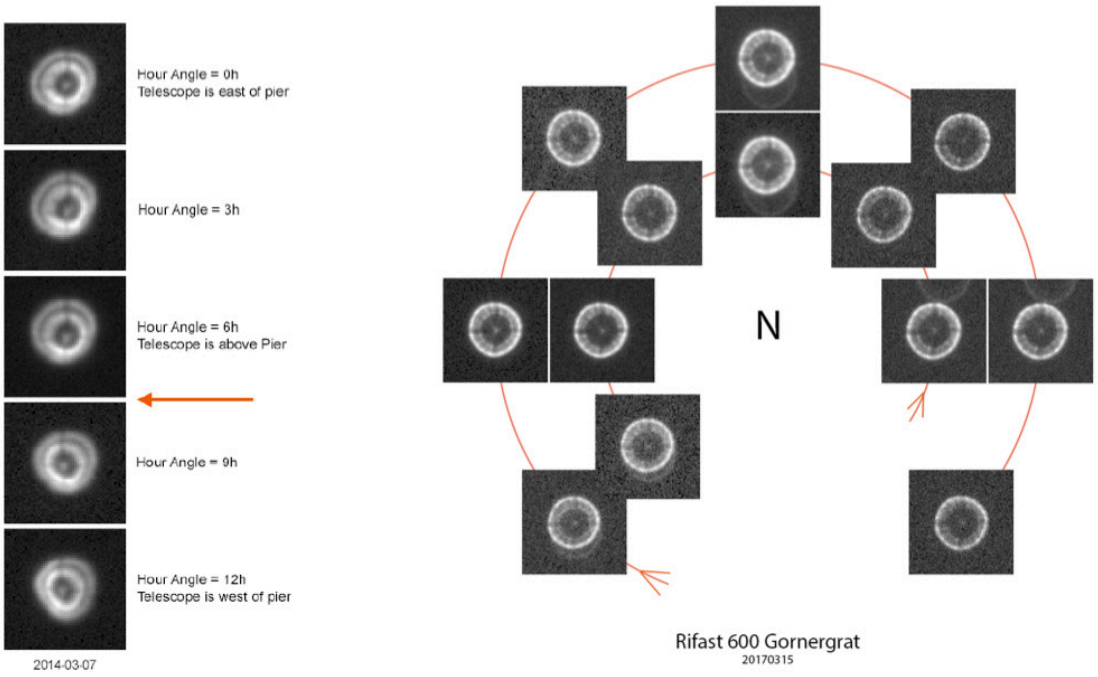

Figure 3. Attitude dependence of the original Rila 600 telescope (left side) compared to the newly installed RiFast 600 (right side). The defocused images clearly demonstrate strong coma that changes with telescope attitude (position) with the older instrument and a much more stable and refined defocused image with the new instrument.

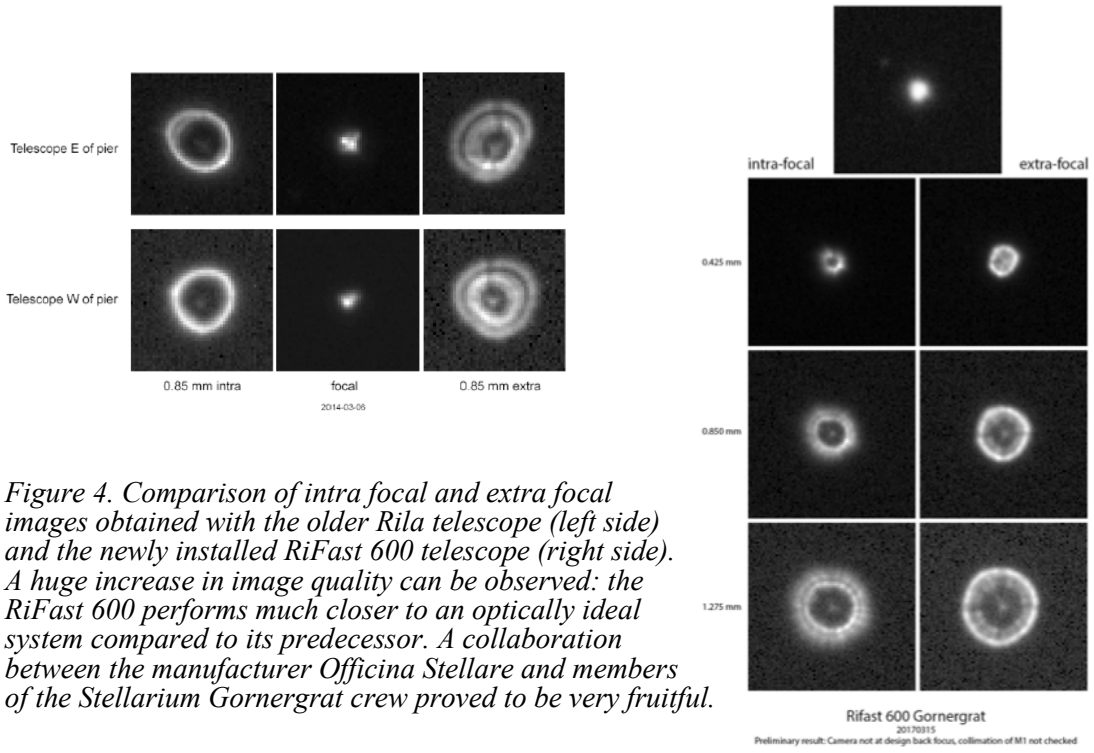

Figure 4. Comparison of intra focal and extra focal images obtained with the older Rila telescope (left side) and the newly installed RiFast 600 telescope (right side). A huge increase in image quality can be observed: the RiFast 600 performs much closer to an optically ideal system compared to its predecessor. A collaboration between the manufacturer Officina Stellare and members of the Stellarium Gornergrat crew proved to be very fruitful.

Personnel:
Dr. Marco Longhitano left the project in fall 2017 due to its transition from the building phase to operation and the inherent decrease of funding. He will continue to support the Stellarium Gornergrat as a collaborator at the Pädagogische Hochschule (PH) Schwyz and PH Bern.

Noticeable visits:
We were visited by the Radio Télévision Suisse (RTS) which produced a nice coverage for the French speaking part of Switzerland. The impact was very tangible as more than 200 new users registered shortly after the broadcast.

Pedagogical Activities
Development of content:
Work on existing and new pedagogical activities is ever on going and performed in both language regions in Geneva and Bern. As the dedicated web portal is now online, we forgo to inform in details about the different development stages of activities at this place but point to the corresponding web resource instead: www.stellarium-gornergrat.ch/portal.

Interactions with schools, teachers, and the public:
At the end of the reporting period, users of ~40 different schools had registered accounts with the Stellarium Gornergrat. The total amount of user accounts is over 300 and ~1000 observing plans have been linked to the telescope since the portal went online. Some of the schools were interested in a closer collaboration (see Table 1), which resulted in many visits and 7 Matura theses. 1144 local visitors were introduced to the project and astronomy.

2017	Type of Interaction	2017 Support for matura theses	Topic
Kantonsschule Wettingen	CSH / Gornergrat Tour in Bern	Anna Friedli, Gymnasium Kirchenfeld	Exoplanets (June & July)
Rudolf Steiner S. Ittigen	CSH / Gornergrat Tour in Bern	Jonas Schweiger, KS am Burggraben, St. Gallen	Hubble-Law, since April
Rudolf Steiner S. Confignon	1 week stage for harmos 11 student	Lena Pritzi, Schweizerische Alpine Mittelschule Davos	Initial support for astrophotography & spectroscopy, April
Kantonsschule Heerbrugg	3-week sabbatical for a teacher working with us	Marco Müller, Feusi Bern	Development of stars, concept and planning, June
Gibb Bern	CSH / Gornergrat Tour in Bern	Margaux Jay, Gymnase français de Bienne	Cepheids, since April
Gymnaisium Biel	CSH / Gornergrat Tour in Bern	Nikola Zurovski, Gymasium Kirchenfeld	Determine the distance of M31, since April
Gymnasium Kirchenfeld	Talk in class (the Martian vs reality)	Sofie Schendzielorz, Kantonsschule Uster	Galileian Moons, since Oktober 2016
Gymnasium Kirchenfeld	CSH / Gornergrat Tour in Bern		
Different Schools	7 matura theses (see table on the right side)		
Gynasium Kirchenfeld	Stutdent Sabbatical 3 weeks in Bern	Teacher training	
PHBern	Presentation of the project	Stellarium Gornergrat crew at the University of Geneva (A. Müller, S. Gschind) organized an official teacher	
sjf workshop	Expert for astronomy school projects	training that successfully took place in March 2017.	

Table 1. Interaction with schools, and teacher training in Geneva (March 2017).

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), Burgergemeinde Zermatt, International Foundation High Altitude Research Stations Jungfraujoch and Gornergrat (HFSJG), Kulmhotel Gornergrat

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