**Integrating and strengthening the European Research Area**

**ERA-NET**

**Coordination and Support Action**

# ASTRONET

## Coordinating Strategic Planning for European Astronomy

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| **Dissemination Level** | | |
| PU | Public | **X** |
| PP | Restricted to other programme participants (including the Commission Services) | |
| RE | Restricted to a group specified by the consortium (including the Commission Services) | |
| CO | Confidential, only for members of the consortium (including the Commission Services) | |

# Contents

## Summary

This report gives an overview of common actions devoted to fostering coordination of national funding programmes in Europe in the areas identified in the roadmap with the purpose of providing a strong added value for European astronomy. In the field of the development of advanced instrumentation for ground-based telescopes there is a plethora of very successful European consortia funded in a coordinated manner by national funding agencies, especially but not exclusively for the construction of instrumentation for ESO telescopes. Efforts were successfully undertaken within ASTRONET to establish new a consortium with sufficient national funds for construction of the wide field spectrograph WEAVE, to be installed at the William Herschel Telescope on La Palma, Canary Islands. In the context of the Virtual Observatory the discussion has reached the level of defining the concrete demand in terms of budget. The overall demand in terms of manpower is expected to be of the order of 35 FTE as compared to 21 FTE presently funded. The relation of the VO to other Big Data related initiatives like the Research Data Alliance (RDA) and the new EU-funded project ASTERICS is under discussion. In the field of human resources training of the next generation of users of future facilities is a third area of common action. In this context offering observing schools for pre-PhD students is a common activity currently being prepared.

All of this work has been done with strong involvement of the WP 5 Working. In addition to the Task Leader PT-DESY the Working Group consists of members of CAS, CNRS, MINECO, NWO and STFC.

## 1. Objectives of the Task

The main goal of Task 5.4 of ASTRONET, "**Prepare further common actions for the coordination of national programmes"**, was to prepare, initiate and implement common actions to foster coordination of national programmes in specific fields based on recommendations in the *ASTRONET Infrastructure Roadmap*. The challenge was to identify topics of common interest for coordinated actions among the funding agencies. The common actions to be initiated should provide an added value for European astronomy and at the same time they should meet the strategic constraints of the involved partners. We describe here the process and achievements to date.

Based on the original recommendations in the *Infrastructure Roadmap*, Task 5.4 focused primarily on actions in the three areas Astrophysical Software Laboratory (ASL), Virtual Observatory (VO) and Laboratory Astrophysics (LA). Further areas in the Roadmap offering opportunities for common actions on the European level are:

- High Performance Computing and grids
- Gaia Data Analysis and Processing
- Wide-field multiplexed spectrographs
- Technology research & development
- Exploitation of facilities
- Human resources: Training & mobility actions

A supplementary activity the agencies was the discussion of common statutes for future common action programmes. As the result of a workshop in October 2013 statutes providing a framework for the implementation of common actions were recommended. The common rules take into account requirements on the level of funding agencies and beneficiaries, including rules for joint calls, the implementation of transnational R&D projects and guidelines for MoUs, LoIs etc..

## 2. Identification of opportunities for common actions

Common actions in the fields of VO, ASL and LA were expected to be largely based on the recommendations by the coordination panels of WP 4 on these topics. Specific common actions were supposed to be considered as soon as the results from the expert committees became available. This happened late in the process of ASTRONET-2: a preliminary assessment of the ASL beginning of 2014 (with some preliminary results in late 2013), recommendations for the VO and Laboratory Astrophysics in March 2015. The late availability of recommendations led to a delay in the concrete activities of Task 5.4.

The recommendations of the expert committees of WP4 reflect basically community interests. This is an important but insufficient element in the process of identifying potential common actions. The identification of topics of common interest can, mathematically speaking, be seen as the result of the convolution of strategic funding priorities and/or financial constraints of the funding agencies with the science-based demands of the community. Therefore a survey addressing the funding agencies was carried out in Task 5.4 in parallel to the activities in WP4 with the goal to identify national funding activities and strategic interests on the level of funding agencies.

The agency survey was performed via a questionnaire targeted at present and future national funding activities and aiming at the identification of overlapping strategic interest in selected areas, as there are:

- Astrophysical Software Laboratory;
- Virtual Observatory;
- Laboratory Astrophysics;
- High Performance Computing and grids;
- Gaia Data Analysis and Processing (Gaia DPAC);
- development of advanced instrumentation for ground-based large-scale research facilities, incl. data analysis and processing;
- development of advanced instrumentation for space-based large-scale research facilities, incl. data analysis and processing;
- Human resources: Training & mobility actions.

The results of the questionnaire were presented to the ASTRONET agencies at a dedicated workshop in April 2012 and were further at numerous consortium meetings thereafter.

As a result of the work in WP4 the ASL recommendations delivered by the expert committee were not considered sufficiently mature yet to trigger immediate common actions but were seen to require further clarification of the concrete needs by the science community. A national call on the topic in the UK in November 2014 issued by STFC did not trigger coordinated activities by other agencies in the partner countries.

For Laboratory Astrophysics specific recommendations for common actions became available only very recently. In future, there may be opportunities for common actions in the field of data bases for Laboratory Astrophysics, but for the time being this is left for the successor organization of FP7 ASTRONET.

Gaia DPAC represents a special case of activity in the ESA context with already strong European-wide support (see Fig. 2 below) requiring no further common actions.

As result of the discussion in Task 5.4 three areas indicating broad agency interest emerged from the process. The fields of human resources and R&D for ground-based instrumentation were identified as promising areas. In addition, due the broad interest in the VO in various countries on the agency level and the continued support by the European Commission for the VO, it was also considered for investigation of common actions in this field.

All of this work has been done with strong involvement of the WP 5 Working Group which had been set up during the 2012 workshop. In addition to the Task Leader PT-DESY the Working Group consists of members of CAS, CNRS, MINECO, NWO and STFC.

## 3. Specific actions initiated

In the following we describe common activities within ASTRONET in some of the three areas identified above, R&D for ground-based instrumentation, Virtual Observatory, and human resources.

## 3.1. Projects in the framework of large infrastructures with European participation and coordinated national funding

Fig. 1 below shows in the form of a matrix a selection of major infrastructure-related projects in the context of large European facilities. This list is not meant to be complete but rather to illustrate the high degree of coordination in funding of infrastructure-related activities in Europe. It focusses on activities which are jointly funded by national ministries, agencies and organizations including international organizations like ESO and ESA with at least 3 European countries involved. Bilateral cooperation are therefore not listed (e. g. EMIR at Gran Telescopio Canarias, which is a cooperation of Spain and France). The list contains instrumentation projects for optical/IR telescopes in the framework of ESO and the Canary Islands observatories, the e-infrastructure VO and, as an example for space science, the joint European activity in the framework of the Gaia Data Processing and Analysis Consortium (DPAC).

| | Country/Int. Org. | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Project | FR | DE | ESO | IT | UK | ES | NL | CZ | ESA | SE | CH | PT | AT | BE | UA | HU | FI | DK | EE | GR | IL | SI | PL |
| MUSE - VLT | X | X | X | | | | X | | | | X | | | | | | | | | | | | |
| CRIRES - VLT | | X | X | X | | | | | | X | | | | | | | | | | | | | |
| SPHERE - VLT | X | X | X | X | | | X | | | | X | | | | | | | | | | | | |
| ESPRESSO - VLT | | | X | X | | X | | | | | X | X | | | | | | | | | | | |
| ERIS - VLT | | X | X | X | | | | | | | X | | | | | | | | | | | | |
| MOONS -VLT | X | X | X | X | X | | X | | | | X | X | | | | | | | | | | | |
| GRAVITY - VLTI | X | X | X | | | | | | | | | X | | | | | | | | | | | |
| MATISSE - VLTI | X | X | X | | | | X | | | | | | X | | | | | | | | | | |
| 4MOST - VISTA | X | X | X | | X | | X | | | X | | | | | | | | | | | | | |
| MICADO - E-ELT | X | X | X | X | | | X | | | | | | X | | | | | | | | | | |
| MAORY - E-ELT | X | | X | X | X | | | | | | | | | | | | | | | | | | |
| HARMONI+LTAO - E-ELT | X | | X | | X | X | | | | | | | | | | | | | | | | | |
| METIS - E-ELT | X | X | X | | X | | X | | | | X | | X | X | | | | | | | | | |
| HIRES - E-ELT | X | X | X | X | X | X | | | | X | X | X | | | | | | | | | | | |
| MOS - E-ELT | X | X | X | | X | | X | | | X | | | | | | | | | | | | | |
| WEAVE - WHT | X | | | | X | X | X | | | | | | | | | | | | | | | | |
| GREGOR | | X | | | | X | | X | | | | | | | | | | | | | | | |
| LOFAR | X | X | | X | X | | X | | | X | | | | | | | | | | | | | X |
| VO | X | X | | X | | X | | | X | | | | | | X | X | | | | | | | |
| Gaia-DPAC | X | X | | X | X | X | X | X | X | X | X | X | X | X | | X | X | X | X | X | X | X | |

*Fig. 1 Coordinated European-wide funding activities: ongoing multinational infrastructure-related projects with at least 3 European participating countries/agencies/organizations*

### *3.1.1. Wide-field spectrographs: coordinated funding for WEAVE*

*Background information:*
*WEAVE will allow astronomers to take spectra of up to 1000 stars and galaxies in a single exposure. This huge leap in observing efficiency (currently only 150 objects can be observed simultaneously) will allow astronomers to tackle several astrophysical problems that until now have remained out of reach. European astronomers are in broad agreement about the need for a powerful multi-object optical spectrograph on a medium-sized telescope in the northern hemisphere to tackle such questions (see report by ASTRONET's European Telescope Strategy Review Committee, http://www.astronet-eu.org/IMG/pdf/PlaquetteT2_4m-final.pdf).*

Initially (2011) the financial situation in respect of funding of the design phase was uncertain and standing in need of coordination with regard to national contributions in order to close a financial gap. By means of interaction within ASTRONET the agencies being at the same time members

of the WEAVE consortium could reach a consensus on funding aspects of the project. The ASTRONET activities gave a positive impulse to the coordination of the consortium contributions that led to an effective distribution of financial contributions allowing closing the gap in the funding of the design phase of WEAVE and in this sense secured the implementation of the project's design phase.

In the course of the process results of the discussions among agencies on national funding for the realization of the design phase of the WEAVE were exchanged among the partners. The involved agencies stated that due to the recent positive developments within the WEAVE consortium, further common actions in the ASTRONET context did not seem necessary for the next stages of the project.

There was consensus among the agencies that efforts within ASTRONET were very effective in terms of coordination of transnational funding during the design phase of the project and that they constituted a common action in the proper sense.

## 3.2. Virtual Observatory (VO)

The European VO activities are concentrated in France, Germany, Italy, Spain, the United Kingdom, Hungary and the Ukraine. In addition, also ESA is active partner in the VO.

The EU-funded project CoSADIE (EuroVO-CoSADIE, two-year funding period 2012-2014) provided important input to ASTRONET. In short, CoSADIE was "*centred on the development of strategies and coordination structures, through a feasibility study for a sustainable European Virtual Observatory giving access to the open, highly diverse, highly distributed data holdings of astronomy. […] It also aims at disseminating results among and gathering requirements from the scientific community (users) and the data providers. It will co-ordinate European technical activities, and includes the promotion and monitoring of international standards, and their adoption through the International Virtual Observatory Alliance IVOA. Co-operation and interface with the grid and cloud will also be assessed. Specific care will be taken to consolidate the high impact VObs outreach activities towards education and the general public*."

CoSADIE has identified three areas of activity required for a sustainable VO. In addition to the programme structure, i. e. the role and contributions of each individual partner, this can be specified in more detail as follows:

- Community support
- Support for data providers: operation/maintenance of data centres
- VO team support: provision of VO tools and services

Beyond the VO, the landscape of data-related e-infrastructures has become more complex recently, a development which should be accounted for when discussing VO needs. In 2012 the cross-disciplinary global initiative Research Data Alliance (RDA) was founded with the goal to foster the convergence of data integration, interoperability and infrastructures[1]. CoSDAIE is represented on the RDA Technical Advisor Board. It appears therefore necessary to clarify the role of the VO with respect to the RDA and to RDA-Europe as the major European partner of RDA in particular.

[1] https://rd-alliance.org/

A further EU-funded initiative to be mentioned is EUDAT (one of the RDA partners) founded 2011 for the creation of a "Collaborative Data Infrastructure" (CDI)[2].

Against the background of the global initiative RDA with its EU-supported European branch RDA-Europe and community driven initiatives like EUDAT the question arises whether pursuing an isolated sustainable solution for the VO is meaningful anymore. It might be more promising seeking alternatively a solution within the cross-disciplinary framework of the RDA initiative when trying to implement sustainable funding by the agencies. The diagram below (*Fig.* ***2***) which is taken from the document "Riding the wave" (2010) of the High Level Expert Group[3] depicts the principles of the CDI. It could be understood as an abstract blueprint of the VO.

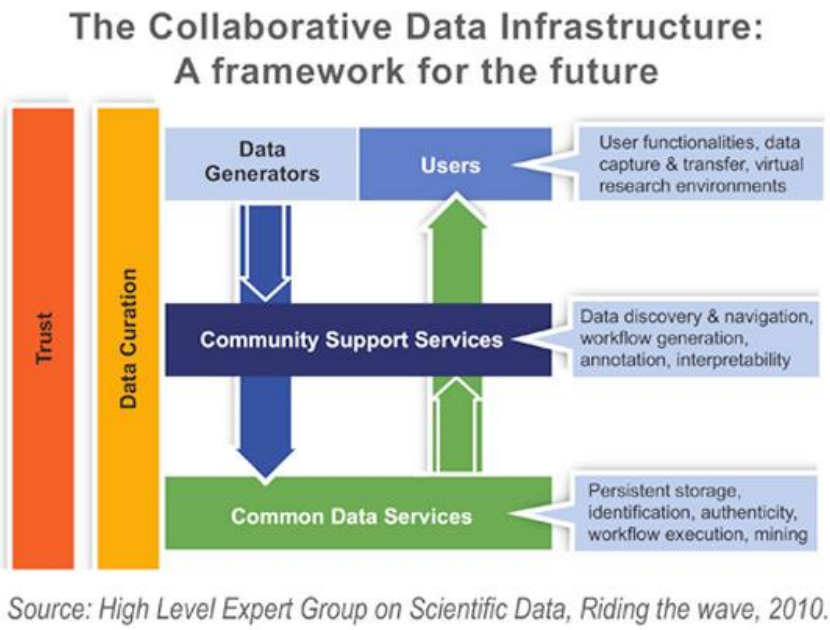


*Fig. 2 Principle structure of the Collaborative Data Infrastructure (CDI)*

Very recently (May 2015) in addition to these activities the EU-funded project ASTERICS[4] (Astronomy ESFRI and Research Infrastructure Cluster) was launched. It also addresses Big Data challenges in the context of large research infrastructures of European astronomy including astroparticle physics. With the main focus on the ESFRI projects E-ELT, SKA, CTA, and KM3NeT it aims at the high-priority infrastructures listed in the *ASTRONET Infrastructure Roadmap*. Other facilities considered are e. g. the already operational Low Frequency Array (LOFAR) and the gamma-ray telescopes High Energy Stereoscopic System (H.E.S.S.) and Major Atmospheric Gamma Imaging Cherenkov (MAGIC). Among the future facilities are the Einstein gravitational-wave Telescope (ET), and the Large Synoptic Survey Telescope (LSST).

For the VO the necessity of a long-term commitment for the operation of data centres is an obvious core functionality of the distributed VO infrastructure. Funds necessary to maintain the structural basis have to be allocated by the participating institutes/organizations. In this framework the legal basis for co-operation of institutional/organizational partners could be an

[2] http://www.eudat.eu/mission-and-vision
[3] http://ec.europa.eu/information_society/newsroom/cf/itemlongdetail.cfm?item_id=6204
[4] http://cordis.europa.eu/project/rcn/196641_en.html

agreement in the form of a Memorandum of Understanding (MoU) defining the statutes of the co-operation.

Based on these considerations the next actions should be:

a) Identification of institutional stakeholders, in particular of data centers and providers of VO services in the different countries.
b) Review of actual funding situation in each country.
c) Investigation of the institutional requirements for a sustainable infrastructure.
d) Identification of funding requirements for a sustainable infrastructure, both on national and European level.
e) Clarification of the relation of VO to RDA and ASTERICS: differences, possible synergies, joint strategies.

These actions have partly been started already and are in process (a, b, d). The overall European demand for a sustainable VO summarized in Deliverable D4.10 of March 2015 amount up to 35 FTE compared to about 21 FTE currently provided through various funding schemes. Investigation of national needs has been started.

The continuation of the work could form part of the work program of the successor organization of ASTRONET which is in the process of preparation at the time of writing.

### 3.3. Human resources: Observing schools for pre-PhD students – training the next generation of users of future large infrastructures

In the area of Human Resources an observing school for pre-PhD students had been identified as a possible common action at the workshop in April 2012.

After extensive preparatory discussions among the funding agencies of the Working Group on the further procedure, 18 Observatories were selected to be contacted in a first step with the letter attached in Annex 1. Twelve positive responses were obtained in which a general interest in organizing an observing school was expressed. The list of observatories with positive responses is given in Tab. 1 below.

In a second step detailed information on capacity and associated costs were requested:

- How many students could be accommodated (supervise)?
- Which time of the year would be acceptable (month of the year)?
- What would be a feasible duration of a course?
- Can the necessary manpower for supervision of the students be provided?
- What would be the overall approximate cost for covering all expenses (accommodation, supervision, training)?

Five observatories answered to this request expressing an interest with concrete proposals:

- National Astronomical Observatory Rozhen
- Tartu Observatory
- Observatoire de la Côte d'Azur
- University Vienna
- Pic du midi

Details are listed in Annex 2.

| Country | Facility/Site |
|---|---|
| Austria | University of Vienna, 1.5m RC telescope |
| Bulgarien | Rozhen National Observatory, 2m RCC telescope, |
| Estonia | Tartu Observatory, 1.5m reflector telescope |
| France | Pic du Midi Obs., Bernard Lyot Telescope |
| France | Observatoire de Haute-Provence (OHP), 1.93m and 1.52m telescope |
| France | Observatoire de la Côte d'Azur (OCA) |
| Greece | National Observatory of Athens, Mt. Helmos, Aristarchos 2.3m telescope, |
| Italy | Osservatorio di Bologna, 1.52 m Loiano telescope |
| Italy | Asiago Observatory, Copernico 1.82m telescope |
| Spain | Calar Alto Observatory (CAHA), Almería |
| Spain | Isaac Newton Group of Telescopes (ING), Canary Islands |
| Ukraine | Main Astronomical Observatory (MAO) of the National Academy of Sciences of Ukraine, Carl Zeiss Jena telescope, |

Tab 1. *List of observatories with positive responses to the request concerning observing schools.*

To summarize these results:

- number of students typically: 10-22.
- The most appropriate time: from May till September (in one case February).
- The duration of the course: 5 days to 3 weeks.
- The necessary manpower for supervision can usually be provided. In Tartu for lecture courses (if necessary) additional manpower is needed.

The costs for 1 student vary from approx. 300€/student/week to 800€/student/week, on the average we face costs of 700€/student/week plus travel costs.

The next step will be to identify the funding sources and then to define the procedure to organise the school(s). This could be one of the first activities of the follow-up organization of ASTRONET.

## 4. Conclusions and way forward

During the course of ASTRONET several common actions have been initiated. One action has been concluded (WEAVE funding), others are still in progress. They could constitute part the work programme of the successor organization of ASTRONET, which is in the set-up process and expected to be launched within the next 12 months.

Concerning WEAVE there was a consensus among the involved agencies that the common actions were very effective in terms of coordination of transnational funding during the design phase of the project constituting a common action in the proper sense. The agencies agreed that

due to the positive development of the WEAVE consortium further common actions in the ASTRONET were not required.

With regard to actions in progress, the organization of observing schools seems a promising area to be pursued. The financial requirements seem manageable, though not yet solved.

In the VO context further extensive work is both, required and desirable. As a global e-infrastructure the VO provides a strong added value not only for the field of astronomy and astrophysics, but also for astroparticle physics. Beyond that it may serve as a prototype e-infrastructure also for other fields in natural sciences. The recently launched EU-funded project ASTERICS adds a new scope to the task of European coordination in the framework of the VO which needs to be taken into account in the future.

## Annex 1

Observing schools: Letter to observatories

Dear Colleague,
Dear Sir or Madam,

On behalf of ASTRONET we would like to propose an initiative in the field of training the next generation of astronomers and request your help as director of major European observatory.

**ASTRONET is an EU-funded network of European funding agencies and ministries, created in order to establish a strategic planning mechanism for all of European astronomy (for more information please refer** http://www.astronet-eu.org/?lang=en ).

**One of the focuses of ASTRONET is advanced joint activities and programming in Europe. An important aspect of joint activities is the training the next generation of users of upcoming new research infrastructures in the field of astronomy and astrophysics.**

**In this context ASTRONET has identified a need for transnational coordinating actions on observing schools to provide access for students and Master students to state of the art telescopes and instrumentation.**

With that said we (on behalf of ASTRONET) would like to ask whether your observatory would be willing to host pre-PhD students and offer training courses, if the necessary funds for this activity are made available for your observatory by appropriate funding agencies. Can you please let me know if you are already providing such a service, or whether you might be willing to participate in a coordinated scheme?

We are looking forward to hearing your hopefully positive answer.

Yours faithfully

Nadja Haebe & Franz-Josef Zickgraf

## Annex 2

Observing schools for pre-PhD students: answers from observatories concerning organizational matters

| **National Astronomical Observatory Rozhen, BG** | **Tartu Observatory, EE** | **Observatoire de la Côte d'Azur; FR** | **University Vienna, 1.5m RC Telescope, AT** | **Observatoire du Pic du Midi, FR Bernard Lyot Telescope** |
|---|---|---|---|---|
| ***How many students could you accommodate (supervise)?*** | | | | |
| 15 to 20 | Approx. 15 | Presently: 22 students; this will be extended to 25 for the next summer at the Calern observing site.<br><br>To access the observing facilities (two 1m telescopes and their focal instrumentation) for night observing experiences the best would be to organize 4 or 5 groups of 5 or 4 students. | Flexible depending on the duration of the course.<br><br>In the case of 2 weeks 20 students can be accommodated.<br><br>There is however some flexibility both in the duration of the school and number of students, depending of the detailed aims of the school. | 10 students<br><br>The participants should organise their trip to the ski resort of La Mongie. |
| ***Which time of the year would be acceptable (month of the year)?*** | | | | |
| June to September | May until September | May, June, first 3 weeks of July, September, October | June to September or February | Approx. 5 training session per year |
| ***What would be a feasible duration of a course?*** | | | | |
| 3 weeks, max one month | 2 weeks | One week (Monday to Friday, | 2 weeks : flexible | 4 nights-5 days |

| | | | | |
|---|---|---|---|---|
| | | exceptionally the week-end). Theoretical lectures can be given in the afternoon, and observations be done during the first part of the night. | | |
| ***Could you provide the necessary manpower for supervision of the students?*** | | | | |
| Several staff members expressed their willingness to be supervisors. The proposed programs start with giving basic knowledge on telescopes, spectrographs, CCDs, data reduction (photometry and spectra, coude and echelle), and continue with practical work at the telescopes, observations of specific astronomical objects. The obtained data will be reduced with the aim every student to solve a very concrete scientific problem. Of course, colleagues from abroad are also welcome to be supervisors and tutors. | Supervision for observations and data reduction can be provided (4 staff members). In addition to the local telescopes supervision of remote observations at NOT (Canary Islands) and Ondrejov (Czech Republic) can be offered. For lecture courses (if necessary) additional manpower is needed. | We can potentially mobilize 5-10 assistant-professors and professors, but that needs new organization, at present 6 of them are available<br><br>There is also 1 technician and 1 engineer in support of our C2PU facility.<br><br>Depending on what kind of matters to be taught 2 other instruments may be mobilized. | We can arrange for a sufficient number of tutors which have experience from similar lab courses | 1-5 Students – one trainer; 6-10 Students – two trainers |
| ***What would be the overall approximate costs for covering all expenses (accommodation, supervision, training)?*** | | | | |
| The costs for accommodation at the observatory are 20 €/person/night (this does not include meals). The charge for using the 2-meter telescope is 900 €/night, and for the 60 cm Cassagrain and the Schmidt telescope - 140 €/night For supervision and training the usual honoraria should be used, which are foreseen in projects with the EC for | Accommodation for students (hostel in nearby town Tartu - 20 km) 30 €/night/student Meals for students (full board - 3 meals) 20 €/day/student Subtotal 50 € x 14 days x 15 students = 10 500 €<br><br>Supervision : calculations based on rate for research staff person | The accommodation cost is about 50 € per diem (room, lunch, dinner, breakfast).<br><br>The cost of supervision is not known presently. The supervision is accomplished within the teaching duty at the institute. | There are youth hostels in the neighbourhood where an agreement for a block reservation could be negotiated. The typical prices are in the range 9-15 € per night.<br><br>Tutors are typically | (1) cable car fees to the summit (2) Room/food costs at the summit (3) training session costs (astronomer and tech. staff from University of Toulouse and CNRS). (1)36 € per stud. (2)236€/stud for 4 nights/5days |

| | | | | |
|---|---|---|---|---|
| full professors and associate professors. | month 4500 €, person month<br>4 persons x 2 weeks: 9000 €<br><br>Additional facilities (lecture rooms, TV, computer..., IT support management) for two weeks 2000 €<br><br>Transportation between Tartu and Toravere for two weeks for 15 students can be jointly organised approx: 2000 € | | PhD students. A first guess could be of the order 30 € per day per person. The number of tutors needed depends on the number of students, as a first guess one can assume that at least 3 tutors are needed.<br><br>The basic use of the facilities would be essentially free. Some costs could arise if special setups for the school regarding the adaption for lab rooms are needed. | (3)1350 + 200 €/ group 1-5 f. 4 nights/5 days<br>or<br>(3)2700 + 200 €/group 1-5 for 4 nights/5 days<br>Total:<br>2910 €/1-5 stud.<br>5620 €/6-10 stud. |
| | | ***Summary*** | | |
| Accommodation: 20x21x15=6300€<br>Observing time: 5X900=4500€<br>Supervision: 3x450x15=20250€<br>Total: **31050 €**<br>for 15 pers./3weeks<br>+ meal and travel costs | Total: **23500 €**<br>for 15 pers./2 weeks<br>+ travel costs | 22 students for one week-><br>Accommodation:<br>50x7x22=7700 €<br>Supervision: 3x450x5=6750 €<br>Evtl.techn.support:1000 €<br>Total: **15450 €**<br>for 22 students/1 week<br>+ travel costs | Accommodation:<br>15x14x20= 4200 €<br>Supervision:<br>30x10x3= 900 €<br>Evtl.500 € for setup<br>Total: **5600 €**<br>for 20 pers./ 2weeks<br>+ meal, travel costs | Total:<br>**5620 €** for 10 students/4 nights-5days<br>+ travel costs |