

Full Proposals for International Polar Year 2007-2008 Activities

Proposed IPY Activity Details

1.0 PROPOSER INFORMATION

(Activity ID No: 385)

1.1 Title of Activity

Towards an international astronomical observatory at Dome C in Antarctica

1.2 Short Form Title of Proposed Activity

STELLA ANTARCTICA

1.3 Activity Leader Details

Eric Fossat
LUAN, Nice University
France

1.4 Lead International Organisation(s) (if applicable)

1.5 Other Countries involved in the activity

Italy
United Kingdom
Germany
Spain
Australia
Belgium
Portugal
USA

1.6 Expression of Intent ID #'s brought together in this proposed activity

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1.7 Location of Field Activities

Antarctic

1.8 Which IPY themes are addressed

5. The polar regions as vantage points

1.9 What is the main IPY target addressed by this activity

4. Legacy

2.0 SUMMARY OF THE ACTIVITY

Dome C in Antarctica is potentially the best astronomical site in the world, with conditions close

to space for some atmospheric windows. An extensive site testing program at the Concordia French-Italian station is underway. Comprehensive results of this program will be available during the year 2007. Small-scale astronomical experiments should also give their first results during the IPY. In 2007, astronomers will then be able to target precisely the best scientific and observational “niches” for astronomy at Dome C. A European network (coordinated action in the frame of the Large Research Infrastructure Research Programmes of EEC), named ARENA has just started in January, 2006, and is devoted to this task. Among the observational niches, some are already clearly identified : submillimeter wavelengths, high angular resolution, as well as Wide field IR and optical observations, and continuous observations over days or weeks. The IPY offers a unique opportunity to discuss with national and international agencies the frame for a large astronomical infrastructure in Antarctica and to undertake its development.

The development of astronomy at Dome C, for which several French and international teams (Italy, Australia, China, Germany, United Kingdom...) have expressed their interest, has to be carried out in several steps. The next two years (2006-2007) will be devoted to the completion of the site characterization in Summer and Winter. The development of small astronomical experiments will additionally provide a good overview of the specific operational constraints that any observatory will face on this site.

In the meantime, the polar institutes and astronomical agencies involved in the Concordia station (INAF and PNRA in Italy, IPEV and INSU in France) will discuss, in collaboration with the Arena consortium, whether and how they wish to open officially Concordia to more international collaborations with the long-term goal of an international ambitious observatory on the site. The frame for international collaborations should ideally be determined before end 2006.

On the scientific side, in 2006 and 2007 several workshops and symposia at the national and international levels will be organized with the aims to survey the scientific topics that can be addressed by polar astronomy.

Our goals during the IPY are then:

- to define the strategy for a development of astronomy at Dome C,
- to propose it to the agencies and to have it endorsed,
- and to increase and develop the funding process.

This strategy should be based on the scientific questions that will benefit most from this exceptional site. It should aim at ambitious experiments: if indeed for some questions Dome C is the best site on Earth, we should build there the best possible telescope with the best instrumentation.

The legacy of STELLA ANTARCTICA will then be a development plan for an international astronomical observatory at Dome C. This plan will have been endorsed by a consortium of national and international agencies, and its funding secured, possibly through actions of the European FP7, and possibly bilateral agreements with countries outside the EU.

What can be foreseen is a development plan in two major steps:

- A first step at the European scale, taking advantage of the existing Concordia station and the capabilities of the present Italo-French logistics. Such a European scale astronomical project could be considered in a range of 10-20 M€ during the next 5 to 10 years.
- The second step could be much more ambitious and target a world wide astronomical project in the range of 500-1000 M€. That will also imply a change of scale of the complete logistics, and must be considered at an horizon of the order of 20 years. Concordia would have then become one of the major world astronomical facilities, and be in the position of playing a key role, like among others, answering one of the fundamental mankind questions: where else in the Universe can Life have developed.

2.1 What is the evidence of inter-disciplinarity in this activity?

- All site testing activities have a tight link with atmospheric studies.
- The building of large infrastructures on the antarctic plateau needs close monitoring of the ice movements, and glaciologists have expressed their interest in the results of this monitoring.
- Undertaking the development of an astronomical observatory at Dome C implies a close interaction with engineering science and the study of a number of enabling technologies.

2.2 What will be the significant advances/developments from this activity? What will be the major deliverables? What are the outputs for your peers?

Major deliverables of CONCORDIA OBSERVATORY will be:

- A strategy for the development of an international astronomical observatory at Dome C, agreed among scientists (2007-2008). This strategy is the major goal of the Arena consortium, that will organise 3 international conferences, the last two being held in Germany (Berlin in 2007) and in Italy (tbd) in 2008, during the IPY. These two conferences could benefit of the IPY label, and provide the final document and proposal to the funding agencies.
- A development plan for this Observatory, agreed among national and international agencies (2008-2009)

2.3 Outline the geographical location(s) for the proposed field work (approximate coordinates will be helpful if possible)

Locations	Coordinates
Dome C	75S 123E

2.4 Define the approximate timeframe(s) for proposed field activities?

Arctic Fieldwork time frame(s)	Antarctic Fieldwork time frame(s)
	03/07 - 03/09
	MM/YY - MM/YY
	MM/YY - MM/YY

2.5 What major logistic support/facilities will be required for this project?

Existing field stations

Icebreaker

Fixed wing transport aircraft

Further details – Existing field station: Concordia (IPEV-PNRA) Ice breaker: Astrolabe
Ground traverses from Dumont d'Urville to Dome C Air transport from Base Mario Zucchelli to Dome C

2.6 How will the required logistics be supplied? Have operators been approached?

Source of logistic support	Likely potential sources	Support agreed
Consortium of national polar operators	Y	
Own national polar operator	Y	
Another national polar operator		
National agency	Y	Y
Military support		
Commercial operator		
Own support		
Other		

2.7 If working in the Arctic regions, has there been contact with local indigenous groups or relevant authorities regarding access?

Not relevant.

3.0 STRUCTURE OF THE ACTIVITY

3.1 Origin of the activity

This activity is the start of a new programme that will outlive IPY

3.2 How will the activity be organised and managed? Describe the proposed management structure and means for coordinating across the cluster

The activity will be managed by the following bodies:

- A Scientific Advisory Board, that already exists in the frame of the Arena network, and is composed of experts from the countries participating in ARENA, with experts from the USA.
- a management Board composed of representatives of the polar operators and funding agencies potentially interested in the project, and composed of experts from the countries participating in ARENA.

The project contains indeed an international/European component, the ARENA network, led by Nicolas Epchtein (LUAN, Nice; EU funding, 2006-2008) and a site testing component, led by Jean Vernin, also at LUAN, Nice (ANR funding 2006-2007).

The overall activities on the French side (site testing and small astronomical experiments) are overseen by a committee (ADC, Astronomy at Dome C) set up by the Institut National des Sciences de l'Univers du CNRS (INSU).

The overall activities on the Italian side (site testing within the IRAIT program with small astronomical instruments, and the medium sized telescope IRAIT, all led by Maurizio Busso and Piero Salinari)will be coordinated by (1):the CSNA (Commissione Scientifica Nazionale per l'Antartide), and the PNRA consortium; by (2) INAF, the National Institute for Astrophysics); by (3), the University of Perugia. These are all partners of ARENA, and have funded the development of IRAIT, the 80 cm IR telescope to be installed at Dome-C during the IPY (first light early 2009).

3.3 Will the activity leave a legacy of infrastructure and if so in what form?

At the end of this activity it is intended that several small-scale astronomical experiments will be operational at Concordia.

But the legacy of this activity is really to create the conditions for starting the development of a large scale astronomical infrastructure on the Antarctic plateau.

3.4 Will the activity involve nations other than traditional polar nations? How will this be addressed?

One possibility is that Concordia become a Large European Infrastructure, partly thanks to the help of the IPY label. That would automatically imply all European countries which are not yet traditional polar nations.

3.5 Will this activity be linked with other IPY core activities? If yes please specify

No

3.6 How will the activity manage its data? Is there a viable plan and which data management organisations/structures will be involved?

Data obtained in the site testing program (e.g. Concordia-astro, IPEV and INSU) will be published in astronomical journals after peer-reviewing. Most of these data will be available on dedicated websites, and all data will be publicly available after one year, as per agreement of the scientists funded by the national Italian and French authorities.

The scientific strategy for the development of an observatory at Concordia will be widely disseminated in draft form, discussed during an international symposium, and made publicly available in final form using the websites of the polar operators and of the astronomical funding agencies. The proposals to the funding agencies will also be public.

3.7 Data Policy Agreement

Will this activity sign up to the IPY draft Data Policy (see website)

Yes

3.8 How will the activity contribute to developing the next generation of polar scientists, logisticians, etc.?

If this activity is successful, part of the astronomical research will be done in a new observatory located at Dome C. This observatory will partly be remotely operated but no doubt that astronomers, telescope operators, engineers and logisticians will be needed at the site.

It is proposed to use a European Mobility programme (1.4 - Marie Curie Conferences and Training Courses) to enable junior researchers, engineers and logisticians to benefit from the experience of leading seniors in these fields.

3.9 How will this activity address education, outreach and communication issues outlined in the Framework document?

Astronomy in general, and furthermore astronomy in such a unique and outstanding location as Antarctica is a very attractive subject for young people and the general public. The questions that can be addressed by an observatory at Dome C are of very wide interest, for example: how did the Universe begin? How will existing stars terminate their life cycle? ? are the characteristics of the planets around other stars favourable to the development of life ? what is the influence of the Sun on the Earth ionized atmosphere ?

The activities foreseen in CONCORDIA Observatory will then be supported by a strong outreach program, aimed towards the general public but also undergraduate and graduate students. Among these activities: diaries of winterovers on websites, press conferences, movies... All reports will have a general public counterpart, and press conferences will be held during scientific symposia. Note that these issues are also the outreach missions of the Arena consortium.

3.10 What are the proposed sources of funding for this activity?

Logistics support: polar operators (IPEV and PNRA for example)

Site testing and astronomical experiments: national agencies such as INSU and ANR, PNRA and INAF.

Coordination for the optical and IR: EC funding (ARENA network).

The site testing programme has already been granted around 800 k€, while the Arena network is a 1.35 M€ European programme.

3.11 Additional Comments

4.0 CONSORTIUM INFORMATION

4.1 Contact Details

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Name	Organisation	Country
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Fabienne Casoli	Institut d'Astrophysique Spatiale, Orsay	France
Nicolas Epchtein	Université de Nice -- LUAN	France
Jean Vernin	Université de Nice -- LUAN	France
Carlos Abia	Universidad de Grenada	Spain
Mark McCaughrean	University of Exeter	UK
Maurizio Busso	University of Perugia	Italy
Gérard Jugie	IPEV Director	France
H. Rauer	Deutsches Zentrum für Luft und Raumfahrt, Berlin	Germany
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Pierre Léna	Observatoire de Paris & Université Paris 7	France
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