The International Polar Year 2007/8

Document of Intent

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for the Belgian National Committee for Astronomy (BNCA)

The international astronomical and astrophysical community recognizes the high potential for observations in Antarctica, as testified by the organization of a special session devoted to this matter during the XXVth General Assembly of the International Astronomical Union (Sydney, July 2003). Even more so, Antarctica is a unique place for top interdisciplinary research, involving in particular cosmochemistry and planetology, as well particle physics.

This document of intent stresses the interest of the Belgian astronomers in tightening or initiating collaborations in various fields as identified below:

1) **Astrophysics**

- Helio- and asteroseismology: long winter nights offer unprecedented opportunities for uninterrupted observational coverage. Belgian teams could be involved in observations with automatic or semi-automatic telescopes. This could be an important support for theoretical and observational work conducted at several institutions, particularly in the frame of the Belgian Asteroseismology Group.

- Infrared and sub-millimeter astronomy: Dome C in particular offers remarkable seeing conditions. The atmosphere is unusually transparent, with extremely low levels of atmospheric aerosols. The amount of precipitable water vapor in the atmosphere is also extremely low. As a consequence, the sky is very dark and transparent in the infrared and sub-millimeter bands, which are very important for the studies of star formation regions (galactic or extragalactic).

2) **Particle astrophysics**

The deepest and most transparent ice-sheet on the planet covering Antartica offers unique opportunities to spectacular developments in high-energy neutrino astrophysics. Such neutrinos are expected to be emitted from the most violent cosmic events, like active galactic nuclei/blazars, massive black holes (quasars), black hole mergers, pulsars/magnetars, etc. In contrast to the ultra-high-energy γ-rays that could be emitted along with the high-energy neutrinos, the latter can reach the Earth almost undisturbed from their sources.

The Antartic Muon and Neutrino Detector Array (AMANDA) at the Amundsen-Scott base has already demonstrated the potentialities of Antarctic ice for high energy neutrino detection. Belgian particle physicists are already involved in the AMADA collaboration.

They will also join the collaboration around Amanda's successor IceCube, a kilometer-scale Cerenkov detector expected to provide first-rank high-energy neutrino observations.

At this point, the Belgian participation to AMANDA has been largely confined to the development of the detection system, and this is also the case for the Icecube collaboration.

The BNCA considers that the Belgian contribution to the coming IceCube detector has to be broadened by setting-up in Belgium an astrophysics research team devoted to the modelling of some of the suspected cosmic objects at the source of high-energy neutrinos that are event candidates for IceCube. This type of research is not conducted in Belgium, and the IPY could be the trigger for its development. This would without any doubt be of substantial interest for many Belgian research teams, and would create at the national level an astroparticle pole through a tight interdisciplinary collaboration between particle physicists and astrophysicists. This pole would also enhance the impact of the Belgian astronomy on the international scene, which is pivotal to the setting-up of fruitful and well-balanced multinational collaborations, especially in the new field called "Astroparticles".

3) **Astrophysics of solids**

Matter arriving on Earth from space is mainly made of micrometeorites. The Arctic and Antarctic snowfields are privileged places for collecting these submillimetric particles, as demonstrated by the research conducted by some foreign laboratories.

Micrometeorites may have played a key role in the formation of the atmosphere and of the oceans. They might even have contributed to the prebiotic chemistry leading to life. Their detailed study may also provide a first-hand information on their very cometary and/or asteroidal origins, and ultimately help unraveling the conditions that have prevailed at the time (about 4.6 billion years ago) of formation of the solar system. There is thus no doubt that the largely multidisciplinary study of micrometeorites is of prime scientific interest.

On the other hand, some specific Antarctica locations have become famous for the collecting of meteorites. These are known to provide invaluable information on the history of the solar system. Some of them are of specific interest, indeed, eleven distinct Antarctica meteorites are known to be of lunar origin, while 12 others are suspected to originate from Mars, and to have trapped Martian atmosphere. These are clearly very special and valuable assests in exploring the origin and history of the solar system.

The CNBA emphasizes the interest of developing the astrophysics of solids in Belgium, which is presently non-existant. This activity would bring together geologists, cosmochemists and astrophysicists.

In conclusion, the BNCA considers that the International Polar Year 2007/8 offers a unique opportunity to trigger new research activities in Belgium. It would also increase the impact of our country on the international scene in broadly interdisciplinary fields of major interest centered on astrophysics, particle astrophysics, as well as on the astrophysics of solids.