Algerian Conference on Astronomy and Astrophysics (ACAA)

“Science for the National Aurès Observatory: Time Domain Astrophysics in the Multi-messenger Era”

PREFACE

Between your hands are the Proceedings of the fourth edition of the Algerian Conference on Astronomy and Astrophysics (ACAA), “Science for the National Aurès Observatory: Time Domain Astrophysics in the Multi-messenger Era”. It was held at Abbes Leghrou University (Khenciela, Algeria) between March 27th and March 29th, 2017.

ACAA was organized by the Research Center in Astronomy, Astrophysics and Geophysics (CRAAG, Algiers, Algeria) in partnership with the University of Khenciela Abbes Leghrou, with the support of the General Directorate of Scientific Research and Technological Development (DGRSDT) and the Wilaya of Khenciela. It follows on the three previous Conferences on Astrophysics held in Batna (2008), Algiers (2009) and Constantine (2010). It aimed at giving to the budding astronomy and astrophysics national community a much-needed space to discuss the most recent research.

With the starting of the building of the National Aures Observatory on top of the Aliness mount in the Wilaya of Khenciela and in the wake of the LIGO’s detection of gravitational waves, the conference this year was dedicated to time domain astrophysics (Gravitational Waves, Gamma Ray Bursts, Supernova…) in the multi-messenger era, as stated in the conference title “Science for the National Aurès Observatory: Time Domain Astrophysics in the Multi-messenger Era”.

The conference topics include Gravitational Waves, neutrino astrophysics, Gamma-Ray Bursts, Fast Radio Bursts, Stellar variability, small bodies in the solar system, etc. Issues related to the National Aurès Observatory, such as site testing, first instrumentation, public awareness have also been discussed as well as the place of this observatory in the perspective of integrating existing and planned worldwide observation networks and other international collaborations. Since there is an
appreciable number of astrophysicists in Algerian universities who work mainly on theoretical aspects of Astrophysics like nuclear astrophysics, cosmology, general relativity, we included these topics with those of the conference.

Here are the main Conference topics with a brief description of their relevancy and importance:

**Observatories, Instrumentation & Systems**

Algeria is in the process of building a new astronomical observatory in the Aurès region. This Observatory will be dedicated mainly to the observation and study of transient astrophysical phenomena. This topic will be devoted to the project of the Aurès Observatory, but also to similar projects around the world, and to the instrumentation and systems that will be deployed. Site testing aspects will also be considered.

**Multimessenger & Multiwavelength Astronomy**

With the first detection of gravitational waves by LIGO on September 14, 2015 (GW150914) and the discovery of astrophysical neutrinos, a new window on the universe was opened. This will allow us to have a new eye on many objects and more specifically on the compact ones (Neutron stars, black holes...). Although often observed first at high energy, these objects emit through the whole electromagnetic spectrum, from radio waves to gamma rays. These objects are panchromatic, and their complete study requires looking at them throughout the whole spectrum. They are also the main candidates for non-photonic emission like cosmic rays, neutrinos and gravitational waves. This topic, include Gravitational Waves, Neutrinos, GRBs, Early SuperNovae, Cosmic rays…

**Small Objects of the solar system**

Small bodies of the Solar System (SBSS) are object of a wide range of sizes that orbit around the Sun. They are comets, meteors and asteroids. During the course of its mission, Gaia will map all sources brighter than visual magnitude ~20. Among these will be thousands of Solar System objects, primarily main belt asteroids circling the Sun between the orbits of Mars and Jupiter. With its ability to detect faint and fast-moving objects, it is expected that Gaia will also detect several thousand Near-Earth Objects (NEOs), which are thought to be comets and asteroids that have been nudged by the gravitational attraction of nearby planets into orbits that allow them to enter the Earth's neighborhood. The detection and follow-up of SBSS is one of the secondary objectives of the Aurès observatory due to their relevance and importance. Recent
observations have dramatically highlighted the relevance of small bodies for the understanding of Solar system’s dynamical evolution. In fact, small bodies bear clear markers of their origin that can help reconstruct the dynamical paths that led to the current Solar system architecture.

**New Trends in Astrophysics**

In addition to the main topics described above, the Aures Observatory will have other secondary objectives. Indeed the main objectives described above will cover only 10% of telescope observing time. The secondary objectives of the Observatory cover a large panel of topics including: Stellar variability, Exoplanets, Space Situational Awareness… All these subjects are included in this topic.

**Cosmology and Nuclear Astrophysics**

As mentioned above, the Conference allowed for astrophysics topics related in some way to the main ones. In particular quite few talks were given in the ever ubiquitous domain of Cosmology both classical and quantum with its strong connection to theoretical physics. In addition, some talks and posters were presented on Nuclear Astrophysics as it related to the stellar and the chemical evolution of the Universe.

This Conference is mainly funded by the National Council of Scientific Research and Technological Development (DGRSDT). We would like to thanks Prof Hafid Aourag, its General Director for his strong support for the project since its inception. The CRAAG has also been supportive of the project both in funding and logistics, and we gratefully thanks his Director Dr Yelles-Chaouche Abdelkrim. We appreciatively acknowledge Khenchela University for their partnership in the organization of this Conference, as well as the support of LPMPS Laboratory at Constantine University and PRIMALAB from Batna University. Finally we would like to extend our thanks to the Khenchela Gouvernorate for their unflinching support and assistance.

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