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International heliophysical year and basic space science in West Asia

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Abstract. This paper summarizes the IHY and BSS activities in West Asia and their importance in many Arab countries, such as Algeria, Egypt, Iraq, Jordan, Kuwait, Qatar, Saudi Arabia, UAE, etc. BSS future plans for some of these countries are as follows: It is proposed by the astronomers from the Arabian Gulf Region to build the Gulf Observatory on top of Jabal Shams (2980 msl) which will have a 2-3 m optical telescope. Libya signed a contract with a French company for building an observatory which will have a 2-m optical robotic telescope. It is also proposed to rebuild the Iraqi National Astronomical Observatory (INAO) which was destroyed during the two wars. It is planned to build a 5-6 m optical telescope and a small solar telescope on the top of Korek mountain, which has excellent observing conditions.

Keywords : education : IHY & BSS, Arab countries, Iraqi National Astronomical Observatory

1. Introduction

International Heliophysical Year (IHY) and Basic Space Sciences (BSS) topics have direct applications in various scientific and technological fields. This includes global techniques for ground-based astronomical and space observations, wireless communications, remote sensing of natural Earth resources using artificial satellites, the study of Earth's environment, atmospheric physics, ionospheric physics, Earth bio-environment, as well as strategic and military applications and other newly-introduced technologies. BSS applications are now common in other fields such as medicine, agriculture, computers, energy, image processing, industry, etc. (Al-Naimiy 2001). For the above and following reasons,

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many Arab countries are thinking of establishing stations for IHY and BSS research and educational centres.

- The studies and observational techniques for research in topics of space and astronomy take advantage of the use of the most cutting-edge technologies. Exceptional technological developments have been encouraged by the needs of IHY and BSS research.

- IHY and BSS attracts young people to science and technology and will keep the Arab countries on track with scientific innovations and technological know-how.

- IHY and BSS could greatly contribute to tertiary education in the physical sciences such as chemistry, geology, and physics.

- IHY and BSS forces education in physical and mathematical sciences to move away from the introspection of science for its own sake and towards science as a practical and useful tool.

2. Education on IHY & BSS for Arab countries

Due to the importance and the fast development of BSS research elsewhere in the world, the related fields should be established at a small or large scale in every Arab country and should be included in the science curriculum of schools and universities, in order to increase public knowledge, understanding and appreciation of the field, as well as for educating scientists, engineers, teachers, researchers, and other science and technology personnel (Baxter 1989; Nussbaum & Novak 1982, Sadler 1998; Percy & Mattai 1999). Students frequently ask about the peculiar celestial objects and sudden events (i.e. comets, eclipses, supernova, black holes, etc.) and sometimes about the origin and fate of the universe, the origin of life, etc. High school and undergraduate students, teachers (Woodruff et al. 1999), and the general public have deeply-rooted misconceptions about day and night, seasons, moon phases, celestial coordinate systems, eclipses, tides, comets, planets, gravity, light, celestial motion and crescent visibility. Ahlgern (1996) suggested strategies for teaching these topics more effectively.

It is also important to relate the curriculum to local Arabic language, culture, historical background and other needs. This is true in all parts of the Arab countries, as it helps to meet another important challenge-reaching women, minorities, and the economically disadvantaged. While the traditional' approach of teaching has some merit, it does not prepare students to develop new solutions to new problems.

3. Summary of the present IHY & BSS activities in a few Arab countries

In the first UN/ESA/NASA workshop hosted by UAE during the period November 20-23, 2005, a regional (West Asia) committee was formed for IHY (http://ihy.boulder.swri.edu/organization/ihy_regional.sh tml). The committee met twice, on 23 November, 2005 and 14 August, 2006 in Amman, Jordan. Around 50 participants representing 14 countries attended. What follows are summaries of IHY and BSS activities in some countries of this region:

Algeria: Astronomy and Astrophysics is mainly done at the CRAAG (Centre de Recherche en Astronomy Astrophysique et Géophysique) previously known as the Bouzareah Observatory, in Algiers. In August 2006, Dr. Samir Naitamor and his group finalized the reception and installation of the VLF receiver in coordination with Prof. Umran Inan. 14 researchers and 22 engineers are working on solar physics, three of them are actually Ph.D students in Max Planck Institute, Germany. The related projects are helioseimology, solar activity, solar astrolabe. Some researchers are working on atmospheric turbulence for daytime measurements. Astrophysics is also done at some universities within the physics research teams. Beside nuclear and plasma astrophysics at Bab Ezzouar and Batna universities, General Relativity and astroparticle physics at Constantine University, Cosmic Ray physics at Annaba University. Space research is done mainly at the CNTS (Centre National des Techniques Spatiales) at Arzew, which is an engineering school and a research centre in geodesy, teledetection and space techniques. It is also in charge of the development of Algerian microsatellite programme (The AlSat series) in coordination with the Agence Spatiale Algerienne (ASAL), in Algiers. Institute National de Geodesie et de Teledetection (INCT) at Algiers is also a dedicated centre for teledection and related activities. Some research activities in geodesy and tele-detection are also carried out at the Earth Science departments of various Algerian universities.

Egypt: Research and postgraduate studies are carried out at the National Research Institute of Astronomy and Geophysics in Hellwan. Kottamia observatory operates a 2-m optical telescope with photometers, a spectrograph and a charge-coupled device camera. The observatory was built in 1963. This telescope is the largest optical/infrared telescope in North Africa and the Middle East. Carl Zeiss Company was involved in modernizing the optical system of this telescope (Deebes & Heileman 1999). The Institute plans to build a radio telescope at Abu Simbel, South of Egypt as part of the European Very Long Baseline Interferometry (VLBI) Network, or EVN, to bridge the gap between the radio telescope in Western Europe and the radio telescope at Hartebeesthoek in South Africa, (Shaltout 1999). Teaching of and training in BSS and solar physics is provided in a few universities, particularly at Cairo University, which has a good astronomy department and about 30 astronomers and solar physicists. In schools, astronomy is a part of the general science course at the primary and preparatory levels and a part of the physics course at the secondary level.

Figure 1. Front view of the 30 mm radio telescope.

Iraq: Professor Rashid Al-Naimiy, the national coordinator for IHY, and his group are conducting research and studies on; Sunspots, Ionosphere, Climate change and develop devices for measuring solar radiation. Currently, they are involved in the following research: (i) the effects of sunspots on the ionosphere, (ii) measurements and modelling of the spectral ultraviolet solar radiation, (iii) developments of simple and low cost devices for solar radiation measurement, (iv) the role of solar effects on the climate change of the Earth, (v) development of computer aided learning modules for teaching Meteorology and Astronomy, (vi) modelling the atmospheric effects on radio signals, and (vii) accurate determination of the sun position relative to Earth.

Iraqi astronomers and space scientists had a good start, established and developed Astronomy & Space Science (ASS) in 1980. They built the Iraqi National Astronomical Observatory (INAO), in Kurdistan, the Northern part of Iraq (Figs 1 & 2), under my leadership as Director General, The Iraqi Astronomy and Space Research Centre including the observatory (INAO) during the period 1980 to 1990. The project was built as a West German joint venture, in a 'Turn-Key' contract, which includes civil work and a residential complex as well. Work started in 1981 and was finished in 1986. The observatory has the following telescopes: (i) 30mm Radio Telescope with a receiver system plus its auxiliaries, (ii) 3.5m and 1.25m Optical Telescope with other astronomical observing equipment such as; IR and UBVIR photometers and different types of spectrographs such as Echelle, Coude, and Nasmyth with other required auxiliaries. The observatory costed U.S $ 150 million (1980 price), and was built on top of Korek mountain (2200 m above sea level), with very good observational site conditions, best seeing observed is $0.5''$ (Al-Naimiy 1986). Unfortunately, this observatory was damaged during the Gulf war in 1980 and

Figure 2. The large optical telescope dome.

1991. Recently we had some correspondence with the local scientists and Kurdistan Government for rebuilding the observatory. A solar telescope and 5-6m optical telescope of modern design has been suggested which will probably fit in the 3.5-m dome.

The current situation of BSS in Iraq is as follows:

Space Research Centre: It is part of the Ministry of Science & Technology in Baghdad. The main research programmes are: remote sensing, wave propagation, communications, astronomy and astrophysics. Physics departments in most Iraqi universities offer courses in astronomy and astrophysics. The College of Science at the University of Baghdad has a good astronomy department, established in 1998 for undergraduate and postgraduate studies in ASS. The College also has a small observatory, 'Al-Battani Observatory', which contains two telescopes: a 40 cm reflector and a 20 cm refractor, purchased from Goto company of Japan. The observatory is located in Tarmia, about 50 km north of Baghdad.

Jordan: The organizations involved in BSS and related activities are: (i) Al al-Bayt University, Mafraq (http://alalbayt.aabu.edu.jo); (ii) Arab Union for Astronomy and Space Sciences, AUASS (http://www.jas.org.jo/union.html, Al-Naimiy & Konsul 2001), (iii) Jordanian Astronomical Society (http://www.jas.jo/index.html), an organization that promotes amateur and sometimes professional ASS, and (iv) Teaching of BSS and general astronomy in Jordanian Schools.

Kuwait: Dr. I. Sabbah installed the First Cosmic Rays Muon Telescope in the Middle East at Kuwait University in order to predict the time of arrival of coronal mass ejections (http://neutronm.bartol.udel.edu/spaceweather/). He also installed a robotic

Sun photometer to monitor aerosol to study desert dust and its effects on climate in collaboration with NASA (http://aeronet.gsfc.nasa.gov/)

Libyan Arab Jamahiriya: Libyan space centre started building a 2m robotic optical telescope in 2005. Observations and research are being carried out for choosing a suitable site. A training programme is being held for astronomers and technicians. The telescope is still in the manufacturing stage.

Oman: Dr. Saleh Al-Sheethani installed a $14''$ RC $\times$ 400 telescope for site testing, a portable telescopes: $12''$, $11''$ and $5''$ Schmidt-Cassegrain telescopes and a $16''$ Newtonian reflector.

Qatar: Sheikh Salman Bin Jabor Althani, Head, Astronomical Department, Qatar Scientific Club is planning to build a Solar observatory, which consists of Coronado Solarmax $40''$ telescope, Coronado Solarmax $90''$ telescope and Coronado Solarmax $90''$ CaK telescope; and Optical observatory ($20''$ RC $\times$ 400^{TM} on MAX Robotic German Equatorial Mount).

Saudi Arabia: Dr. Hassan Basurah and his group are carrying out daily sunspot observations (Monthly sunspot analysis to SIDC - Belgium). Recently they installed a cosmic ray muon observatory and observed stellar occultation.

Syrian Arab Republic: Plans exist for building a 2m optical telescope. The country has two active societies, the Syrian Cosmic Society and the Astronomical Amateur Astronomy Society.

The Gulf Observatory: An observatory with a 2m optical telescope proposed by astronomers from the Arabian Gulf region (Bahrain, Kuwait and the Sultanate of Oman), is to be built on top of the Jabal Shams (2,980m above sea level), in the Sultanate of Oman. It is planned in the near future for a site-testing programme for this mountain.

4. Conclusions

In the Arab region, it is very important to establish two main education and research centres in the fields of IHY & BSS. These centres could currently be associated with the Arab Space City (ASC), and the Arab Astronomical and Solar Facility (AASF). The AASF would be oriented towards supporting higher education and university level astronomical and space science research and development. It will also have solar, optical and radio observatories, located on a good astronomical site, with a major support centre comprising of assembly and lecture halls appropriate to hosting sizable conferences as well as laboratory and classroom facilities, which would be built in association with or near to the already established infrastructure of a university. The ASC would be established in the vicinity of the capital city of any Arab country. These themes would be developed by the introduction of the important history of Arabic and ancient middle-eastern discoveries

and contributions to the science of astronomy up to and including the present epoch, via the Solar physics, Astronomy and Space Museum, the Interactive Astronomical Image Gallery, the deeply moving Planetarium and other solar activities. The main focus will be to provide the awareness of science and technology with importance to astronomy and space science among the general public, students and younger children. With a 500-600 seated planetarium, for example, there would be every reason to encourage school children from virtually every nation of the Arab World to come to ASC to have this experience. It would be such an experience to see the wonders of the universe, and participate in personal hands-on space and astronomy activities, space-camps, flight simulators, observe real-time solar activity with a dedicated solar imaging telescope, see special exhibits depicting current space activities such as comet sightings, asteroid missions, lunar and Mars exploration activities, space satellites, and activities on the International Space Station. There would always be a connection to the activities at the suggested AASF. This aspect of the ASC would both stimulate and educate the public at large, and give rise to new generation of students to populate the science curriculum of the Arab universities and indeed all colleges and universities as well.

References

Al-Naimiy, H. M., 1986, ApS&S, 118, 51

Al-Naimiy, H. M., 2001, Teaching of Astronomy in Asian-Pacific Region, Bulletin No.17, 13

Al-Naimiy, H. M., & Konsul, K., 2001, Astronomy and Space Sciences in Jordan. Teaching of Astronomy in Asian-Pacific Region. Bulletin No.17, 27

Ahlgren, A., 1996, in Astronomy Education: Current Developments, Future Coordination, ed. J. R. Percy, ASP Conference Series 89, 26

Baxter, J., 1989, Int. J. Sci. Ed. 11, 502

Deebes, H.A., & Heileman, W., 1999, Sun, Sand and Stars, Cieux African Skies, no. 4, 7

Nussbaum, J., & Novak, J., 1982, Instructional Sci. 11, 183

Percy, J. R., & Mattei, J. A., 1999, in Teaching of Astronomy in Asian Pacific Region, Bulletin No. 15, 51

Sadler, P. M., 1998, JRScT, 35, 265

Shaltout, M.A.M, 1999, The Abu Simbel Radio Telescope Project, Cieux African/African Skies, no. 4, 10

Woodruff, E., Chandra, N., Kalchman, M., & Percy, J. R. 1999, Universe in Your Classroom, Toronto, Canada, 3 July 1999