

# International Heliophysical Year and Astronomy and Space Science Activities in Arab States: Concentration on United Arab Emirates and Iraq

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**Abstract.** This paper summarizes International Heliophysical Year (IHY), astronomy and space sciences (ASS) activities in many Arab countries with the concentration on Iraq and UAE. The level and type of these activities differ in each country.

-The paper shows also the current activities on topics related to IHY in different countries, following are suggested future Astronomy and Space Science (ASS) plans in some of these countries:

-UAE Research Centre for Solar Physics, Astronomy and Space Sciences: A proposal under consideration for building a Solar Physics and Space Research Centre that may contain: Solar, radio and optical observatories, and Very Low Frequency (VLF) Receiver for remote sensing the Ionosphere on UAE region. The proposed research project will facilitate the establishment and conduct of VLF observations in the United Arab Emirate (UAE) as a part of Asia sector, thus providing a basis for comparison to facilitate global extrapolations and conclusions.

-Iraqi National Astronomical Observatory (INAO): The Kurdistan Government/Universities planning to rebuilt INAO which has been destroyed during the two wars. Proposed suggestion is to build a 5-6 meters optical telescope and small solar telescope on the top of Korek Mountain, which has excellent observing conditions.

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## Introduction

Arab Participating Nations in the IHY activities are: Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, UAE and Yemen.

The IHY-Western Asia initiative has played a fundamental role in each of the four Programmatic Thrusts of IHY. The first UNBSS/ESA Workshop on IHY was held in Abu Dhabi and Al-Ain, United Arab Emirates, in 20-23 November, 2005. Representatives from 44 UN member states were present, representing a large portion of the Western Asian regions as well as Northern Africa. This allowed extensive discussions of the state of heliophysical research in these regions, and facilitated planning for IHY national and regional regions (<http://www.ihy.uaeu.ac.ae/workshopbg.htm>).

IHY has coordinators in place for many of the nations in the Western Asian region, with the goal of establishing a coordination team in each nation in early 2006 [1]. In addition to hosting the first UNBSS/ESA Workshop on IHY, IHY-Western Asia team members are active in coordinating scientific activities which will lead to many scientific campaigns. The region's extensive activities for the World Year of Physics 2005 (<http://www.physics2005.org>) have resulted in experience and a foundation for the continued development of educational programs, summer schools, and historical events.

During the 1st UN/ESA/NASA workshop hosted by UAE for the period November 20-23, 2005, a regional (West Asia) committee was formed for IHY. Since then the

committee met many times, first meeting was on 23 November, 2005 and the second meeting on 14 August, 2006, in Amman, Jordan, and the 3 March, 2008 in Sharjah, UAE. At that meetings around 50 participants represented 14 countries from Iraq, Palestine, Bahrain, Egypt, Jordan, Kuwait, Libya, Oman, Saudi Arabia, Syria, Qatar, UAE and Yemen.

The participants discussed the current research projects and the future cooperation on IHY and gave summaries for their activities in their countries.

## Current and Future IHY and ASS activities in Iraq and UAE

### Iraq:

#### *(a) IHY activities:*

Many physicists and space physicists are currently conducting research and studies on sunspots, ionosphere, climate change and develop devices for measuring solar radiation. As an examples we can mention:

1. The effects of sunspots on the ionosphere;
2. Measurements and modelling of the spectral ultraviolet solar radiation;
3. Developments of simple and low cost devices for the solar radiation measurement;
4. The role of solar effects in the climate change of the Earth;
5. Development of Computer Aided Learning Modules for teaching meteorology and astronomy;
6. Modelling the atmospheric effects on radio signals;
7. Accurate determination of the Sun's position relative to the Earth.

**(b) ASS activities:**

Iraqi astronomers and space scientists started with good steps and established and developed ASS in 1980.

**TABLE 1**

	Sinjar	Korek
<i>Altitude</i>	1500 m	2127 m
<i>Longitude</i>	41° 45' E	44 °28' E
<i>Latitude</i>	36° 28' N	36° 35' E

telescope of modern design has been suggested which probably fit in the 3.5-meter dome; see appendix II which includes number of photos shows the large damages made by the two wars on the observatory [1].

Selection of the site made with the help from Soviet, Egyptian and American astronomers. Two sites were selected (Table 1) and a site testing program accomplished in both sites. The program included the monitoring of meteorological data and seeing measurements using the Polaris Trail Telescope (PTT)

**TABLE 2**

<i>Seeing in sec of arc</i>	$\leq 1''$	1.1"-1.5"	1.6"-2"	$> 2''$
<i>Korek</i>	18%	43%	18%	21%
<i>Sinjar</i>	9%	13%	15%	63%

They built "The Iraqi National Astronomical Observatory (INAO)", in Kurdistan, the Northern part of Iraq. INAO project built as a West-German joint venture, in a "Turn-Key" contract, which includes as well civil work and a residential complex. Work started in 1981 and the last section of the project finished in 1986. The observatory comprises the following telescopes:

- 30 meter Millimetre Radio Telescope with a receiver system plus its auxiliaries;
- 3.5 meter Optical Telescope and 1.25 meter Optical Telescope with other astronomical observing equipment is also included such as; IR and UVIR photometers and

method developed by Prof. M.F. Walker from University of California at Santa Cruz. The programme was carried by Iraqi personnel assisted by a group from the Royal Greenwich Observatory (RGO). PTT plated were processed and evaluated by Walker.

Table 2 shows seeing measurements for both sites (October 1977 - January 1978). According to these results, Mt. Korek was selected, but site testing continued for a full year (October 1977 - August 1978). Results are compared with other international sites (Table 3).

**TABLE 3**

<i>Location</i>	<i>Best seeing observed</i>	<i>Sec of arc</i>				<i>Total nights</i>
		$\leq 1.0$	1.1 to 1.5	1.6 to 2.0	$> 2.0$	
Junipero Serra	0".5	26	38	13	23	558
Siero Toledo	0".7	24	32	22	22	509
Korek	0".5	11	29	23	37	106
Kitt Peak	0".75	15	30	16	39	253
San Pedro	0".75	15	25	17	42	2
Martir						
Piper Mountain	0".75	9	30	20	42	164
Mt. Mckinley	0".75	2	32	20	46	50
Sinjar	0".75	1	19	212	59	100
Flagstaff	0".0	1	5	29	65	80

different types of spectrographs such as Echelle, Coude, and Nasmyth with other needed auxiliaries. The observatory costs U.S \$ 150 million (1980's price) and built on top of the Korek mountain of 2200 metres above sea level with a very good observational site conditions [2].

Unfortunately, this observatory was damaged during the two wars (1980 and 1991). Recently we had some correspondence with the local scientists and Kurdistan Government for rebuilding the observatory at Korek Mountain. A solar telescope and 5-6 meter optical

**(c) The current situation of ASS in Iraq**

Space Research Centre: It is a part of the Ministry of Science and 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.

Secondary schools include small general topics about astronomy in the physics courses that they offer, covering such topics as day and night, moon-Earth system, solar system, stars.

#### United Arab Emirates:

The research activities related of IHY in UAE will be started by install a system for remote sensing measurements at site of UAE.

The research project will facilitate the establishment and conduct of Very Low Frequency observations in the United Arab Emirate as a part of Asia sector, thus providing a basis for comparison to facilitate global extrapolations and conclusions.

#### **(a) Brief background**

The VLF measurements are particularly useful as a sensitive tool for the measurement of ionospheric conductivity, especially at altitudes below 90 km.

Mainly two different primary types of subionospheric signals of Very Low Frequency have been used to monitor the various phenomena associated with ionospheric disturbances. These are early/fast VLF conductivity changes and LEP Events [3].

#### **(b) Methods of inquiry and analysis**

Events of both types will be regularly measurable at the Sharjah University site with a collaboration of the research team at the Stanford University. These measurements will allow the quantitative determination of any significant differences between the European and the American hemispheres, thus enabling the scientists to better assess the role of lightning-driven electrodynamics coupling between upper atmospheric regions on a global scale. In this context, it is important to note that the monitor equipment that will be installed at Sharjah university must be Stanford-built, so to ensure it is identical in every way to those utilized at other sites distributed all over the world.

The main objective of this proposed research project is to initiate a research program designed to address outstanding scientific questions concerning transient and localized variations of the nighttime lower ionosphere (<90 km) in the context of a cooperation between the University of Sharjah in the UAE and Stanford University in the USA [4].

Accordingly, the proposed project must follow the well established methodology adopted by the research team of the Stanford University. This includes the deployment of the VLF receiver equipment at the Sharjah University campus in cooperation with the scientists from the Stanford University. This initial scientific cooperation is essential in view of the highly specialized nature of the proposed measurements, which have been pioneered by the researchers at the Stanford University during the past two decades. The block diagram of the installed system is shown in Fig.1.

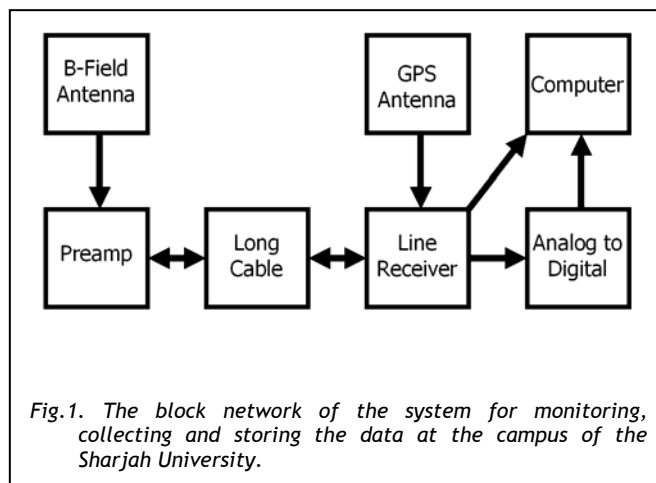


Fig.1. The block network of the system for monitoring, collecting and storing the data at the campus of the Sharjah University.

#### **(c) Significance of the project**

The proposed project will greatly enhance the ability for ionospheric imaging over the UAE and will begin to provide a picture of the nature of thunderstorms over Arabia, and even the Middle East, Far East and Centre of Africa.

We expect the system will be installed by March 2009 and the collection of the data will be started by April 2009 in closed collaboration with the research group of the Stanford University.

#### **IHY and ASS cooperation between Arab Countries**

I. Enhancing IHY and ASS facilities and research centres in Arab countries requires cooperation with international institutions in general and among many Arab universities and organizations, in particular. Establishing good IHY and ASS in any region cannot be accomplished without strong cooperation between different communities. In Arab countries, everything for IHY and ASS development is available (such as budget, personal, sites, environments, etc), the only thing missing is cooperation and scientific support from international organizations and scientists.

II. Building good, modern observatories and IHY stations in the region jointly by Arab solar physicists, astronomers and scientists is essential and will be an excellent step towards developing IHY, astronomy and astrophysics, particularly when the stations and the observatories contain modern size solar and optical telescopes with their auxiliaries, besides a millimetre radio telescope to be part of any International VLBI system. Keeping in mind that there are very good sites for observatories and desert for IHY stations in different parts of Arab countries, particularly in those places where observations can be made of both southern and northern parts of the sky. It might be useful if the observatories were to be built in collaboration with AUASS and IHY West Asia committee.

#### **Conclusions**

In the Arab region, we think it is very important to establish two main Education and Research Centres in fields of IHY and ASS. These centres could currently be associated with this initiative: 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, hence its centre-piece would be the solar, optical and radio observatories, located on a good astronomical site, with a major support centre comprising 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 and would focus on providing the larger general public with inspiration and awareness of the importance of science and technology on their own lives and especially on the lives of their children and on inspiring younger students towards a career in science through the message of astronomy and space science. 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 the continues solar activities show experience, using a range of topics, changing according to monthly themes, to bring many viewers back time and again to be refreshed, recharged with enthusiasm, and (re)inspired to seek their own way in the quest of knowledge and discovery. With a 500-600 seat planetarium, for example, there would be every reason to encourage classroom groups of 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, activities on the International Space Station. There would be always 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 generations of students to populate the science curriculum of the Arab Universities and indeed all of the nation's colleges and universities as well. Such an arising awareness and affinity with sciences taken on balance with the great moral and spiritual strengths imbued through Islam give tremendous promise to a most fulfilling future for all the peoples of region, the entire Arab World, a vision of harmony combined with maximum personal achievements for everyone, a vision which we all dream of together, deep within our hearts of prayer, God so Willing. In a country encouraging the development of science and technology, it is natural to build a large and important IHY and ASS centres [5].

One of the main goals of the IHY and space initiative is to promote the Arab astronomy heritage and to become a core scientific research centre not only for Arab countries, but for all the Middle East and perhaps for Asia. It will also provide life information for the space

sciences to the public community. It will show how important the IHY, space science and technology is for humans. The project will concentrate on scientific research, education, learning, knowledge and scientific entertainment. This will be through the exploration of the Universe and the discovery of the cosmos and celestial objects, which gives great achievements to the human community.

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