

Chapter 5.4

ASTRONOMY IN SAUDI ARABIA: THE CHALLENGES

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Abstract In the last thirty years, more than hundred astronomers graduated from the astronomical departments of King Saud University and King Abdalaziz University. About 15-20% of them are working in basic space sciences or education, related to astronomy. In this paper, the problems and challenges that astronomers in Saudi Arabia face are presented, such as the limited number of astronomers as compared to the astronomical facilities available in S.A. e.g. more than eight reflectors (range from 14" to 21"), two solar labs. and some others small instruments. The lack of under or post-graduate students, and the limited support from higher authorities in the universities. The paper gives some recommendations to overcome some of these problems.

Introduction

Astronomy, as a science, is important in Saudi Arabia, because it is closely related to their Islamic religious practice. Astronomical knowledge is needed to calculate prayer times, to find the Kebla (Makkeh direction), and to define the date of Ramadan (Fasting month) and Thoalhijah (Pilgrimage month) by new moon sightings (Helaal). Also the holy book "Al-Quraan" directs the attention to the universe around them, and asks to try to know "how the creation started". Such stimulus encouraged, in past times, Moslem scientists to study astronomy very deeply, and make great efforts over many generations.

One would expect this tradition to have continued in the Moslem religion into the current times. Unfortunately that is not the case. This is mainly due to a weak back-ground in astronomical knowledge among the

people, the lack of under-graduate students, and the lack astronomical research and researchers.

1. Professional Astronomy in Saudi Arabia

Modern astronomy has now been taught in Saudi Arabia's (S.A.) universities for more than thirty years. There were two full departments, in the King Abdulaziz University (KAU) in Jeddah, which has an Astronomy degree program. The second is at the in King Saud University (KSU) in Riyadh. Although the Physics Dept. has the name "Physics and Astronomy Dept.", it does have neither a graduate nor an undergraduate Astronomy or Astrophysics degree program.

In addition to these two departments there is the Institute of Astronomical and Geophysical researches (IAGR) in the King Abdulaziz City for Science and Technology (KACST).

More than 100 astronomers have graduated from both KAU and KSU, less than ten continue through the Ph.D., about five graduate with an M.Sc. and continue to work for Ph.D., and less than five are studying for a M.Sc. Also some physics graduates work in astronomy.

In KACST some astronomers with B.Sc. degrees work in IAGR. A few astronomers are employed in the Science museums and planetariums. Less than five astronomers work for the military, and most of the remaining astronomers work in education, teaching mathematics and/or physics. So approximately 15%-20% of the astronomy graduates are employed now in basic space science related to astronomy, the rest are not, and that illustrates the number of interested students. Most these astronomers are Saudis, the first Ph.D. was granted in 1985, and the last was in 1999. Some non-Saudis work as university staff members in KAU and KAU.

Both KSU and KAU have Celestron 14" (C14) telescopes with photometers, a 15cm Coudé refractor, a Solar laboratory, a small planetarium and other astronomical instruments. In addition KAU has a CCD camera, and KSU has a double telescope with a 45cm Richy-Chrétien and a 24cm Schmidt telescope. The observatories at KSU and KAU are located near the universities, where the light pollution is very high, limiting the observational possibilities.

Through a special Royal Decree, KACST is in charge of large-scale astronomical projects, such as the National Observatory Project (NOP). The KACST site selection program for NOP started towards the end of the 1970's with the help of a Canadian team and an American consultant. The oil fires in the region and various conflicts have strongly affected the Saudi atmosphere, and delayed the project. Also, the earthquakes in

Egypt, which directs most of the efforts in Geophysics projects at IAGR and KACST, generated delays for many astronomy projects.

KACST have four 15cm Coudé installed throughout S.A. for NOP site selection, and three C14" for Islamic crescent visibility. KACST has a large database of ten years of solar observations made at the Solar Village in Oiaina (near Riyadh). Moreover, KACST has acquired a Laser/Lunar ranging telescope (75 cm). This telescope will be used for Geodesy and Geodynamic studies and research, mainly for earth rotation, polar motion and Time-Service.

A 3m Radio Telescope has been designed by Electrical Engineering Dept. and Astronomy Department of KSU to observe sun and may be stars. Figure 5.4-1 shows the location of all these astronomical facilities.

For the Time-Service, still elementary in S.A., KSU has three atomic clocks in the Astronomy Department with a GPS receiver in the seismological observatory. KACST has a GPS in the Remote Sensing Institute. The responsible organization for time keeping and dissemination is the Standardization and Metrology Organization for G.C.C. countries (SMO). SMO has two atomic clocks. A closer communication and cooperation started between KSU and SMO some time ago, but has stopped now.

2. Amateur Astronomy in Saudi Arabia

During the last few years the General Presidency of Youth Affairs has supported free courses for amateur astronomers in Riyadh, and plan exist to establish a association. A L200 Meade 10" telescope has been acquired for use by amateur and professional astronomers. In Jeddah, the private sector supports a Science Club, which develops most of its activities in the field of Astronomy through Jeddah Center for Science and Technology.

There are three large planetariums (each seating more than 100 visitors) all of them in Riyadh. None of them are open for the public visits till now. The oldest is used for military studied in the Department of military survey, the second is used to teach students of the Islamic University of Umam Mohammed bin Saud under the supervision of the Geography Department, and the third is in King Fahd Cultural Center which has not yet officially opened. Most of the shows are related to astronomy. In the Science Oasis a small plastic planetarium is open for visitors, twice a day.

There are two science museums in S.A.. The largest is the Jeddah Center of Science and Technology in Jeddah, which has no planetarium. The second one is at the Science Oasis in Riyadh.



Figure 5.4-1. The Distribution of astronomical instrumentation within Saudi Arabia.

Both Departments in KSU and KAU are open for schools to visit and learn about astronomy. In KSU, open nights for the public are regularly scheduled.

It is expected that all the activities, described above, will improve the astronomical and general basic space science awareness and increase the interest for professional and amateur astronomy. It is estimated that among the two million people in Riyadh, about 200 people have a private telescope, a ratio of (0.001%) not that good, but the hope of a fast improving is there.

Some amateur astronomers have very good astronomical equipment, for example H.M. prince Moqren Al-Saud has a fully computerized 21" reflector telescope (in Hail- in the north of S.A.) with a CCD camera and spectrograph. H.M. is offering his observatory for all astronomers to use, but the location of the observatory is not easy to access from the work places of most of the astronomers.

Table 1 and 2 summarize the professional astronomical manpower and astronomical instruments in Saudi Arabia.

Table 5.4-1. Astronomical manpower in S.A.¹⁾

	Ph.D.	Graduate Students	M.Sc.	Pre-Grad. Students	B.Sc.	Under Graduate Students	Technical personnel
KSU	1s 2n	1s -	0s 1n	- -	2s -	- -	1s -
KAU	5s 1n	0s -	0s 2n	- -	- -	- -	- 1n
KACST	2s 0n	0s	2s	2s	7s	-	4s
SMO	-	-	-	-	-	-	-
Others	3	-	-	-	5s	-	3n
Total	14	1	5	2	14	-	9

¹⁾ In the table (s) is for Saudis and (n) for non-Saudis

Table 5.4-2. Astronomical instruments in S.A.

	C14"	15 cm Coude	45 cm & 24 cm	C8" or 21" refr Meade	Solar lab.	Atomi c clocks	Plane- tarium	Photo- meter	CCD	Radio obs.	Laser ranging
KSU	1	1	1	-	-	1	3	1	1	2	1 not in - use
KAU	1	1	-	-	-	1	1	1	2	2	-
KACST	3	4	-	6	-	Solar village	2	1	2	3	2 can 1 be used
SMO	-	-	-	-	-	2	-	-	-	-	-
Amateurs & others	2	3	-	14	1	-	-	6	1	2	-
Total	7	7	1	20	1	3	8	9	6	9	3

3. Problems and challenges' face Astronomy in S.A.

The following are the most important problems and challenges that face basic space science and astronomy in S.A. specially the researches:

1. As can be seen in Table 2 and comparing with table 1 (and figure 5.4-1) the number of active astronomers in S.A. is relatively low compared to the astronomical facilities available.
2. The large distances and limited transport infrastructure between the observatories make travel hard.
3. The observatories associated with the Universities suffer from light pollution.
4. The limited career possibilities for graduate astronomers, limit the number of undergraduate students.

5. The small number of undergraduate students that finish the career now, together with the essential absence of postgraduate students, create a heavy load for the academic staff, limiting the time available for research. Of course the absence of students in the basic space sciences also affects the departmental budget negatively and its image in the University, resulting in a decrease in resources, such as professional journal subscriptions.
6. The differences in specialization among Ph.D. astronomers, make it difficult to do team research.
7. The language of publication in the basic space science is very different from Arabic.
8. Astronomical outreach is very important for local astronomers for the departmental survival, but it does take time away from research activities.
9. Astronomy and basic space science education is not available in the curriculums in the public schools. Also a clear shortage of teachers at college level is present.

All the above reasons affect basic space science research in Saudi Arabia. Urgent action to remedy this situation is needed. The first step should be taken by the scientists themselves. The active participation in the programs of international organizations such as IAU support offers many opportunities. I think here e.g. of free periodicals and observatories preprints, reduced cost subscriptions. Participation of Saudi astronomers in the IAU astronomers exchange programs will help to upgrade the level locally. Saudi Arabia could request the IAU, COSPAR or UN support in NOP through advise and consultancy for KACST. This is important since the foundation of a big national telescope in Saudi Arabia will clearly enhance the support and improve the image of basic space science in the country.

4. Conclusion

The number of astronomers in Saudi Arabia small compared to the available astronomical facilities. A good and organized cooperation between African and Western Asian astronomers can produce an important stimulus for basic space sciences in Saudi Arabia.

Even though astronomical outreach publicity and stimulation of students' interest the task of the local astronomers, they can benefit very much from experiences of others, and learn how to overcome the national problems. International cooperation is essential to improve the ability and the quality of basic space science research in Saudi Arabia. The local astronomers hope that efforts in this can be stimulated and will contribute to productive collaborations.