

**Revista Mexicana de  
Astronomía y Astrofísica**

Revista Mexicana de Astronomía y Astrofísica

ISSN: 0185-1101

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México

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Revista Mexicana de Astronomía y Astrofísica, vol. 45, 2014, pp. 26-27

Instituto de Astronomía

Distrito Federal, México

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## TAKE A LOOK AT THE ANCIENT OBSERVATORIES IN IRAN AND PROSPECTS FOR THE FUTURE

F. Kayanikhoo<sup>1</sup> and F. Bahrani<sup>1</sup>

### RESUMEN

En este artículo, queremos hacer una introducción a los antiguos observatorios de Iran y estudiar las aplicaciones de dos de ellos en tiempos antiguos. Luego, introduciremos uno de los observatorios robóticos de Iran que está ubicado en la universidad de Kashan. También estudiaremos diversos aspectos del Observatorio Nacional Iraní que es un observatorio robótico bajo construcción

### ABSTRACT

In this article, we want to introduce ancient observatories of Iran and study about applications of two of them in ancient times. Then, we will introduce one of the robotic observatories of Iran that is located in university of Kashan. We, also, will study about features of Iranian National Observatory that is an under construction robotic observatory.

*Key Words:* history and philosophy of astronomy

### 1. INTRODUCTION

Iran, from ancient years was an excelled country in construct and use of astronomical buildings. It's obvious, that in a country with clear and beautiful starry nights people tend to discover this beautiful firmament secret. Using these astronomical buildings and instruments for calendar and discovering sky by Iranians, show their wisdom and knowledge and rich culture. Historical-astronomical buildings in Iran are Includes: Shahr-e-Goor observatory, Maragheh observatory, Historical buildings Persepolis and Naghsh-e-Rustam solar observatory. We introduce two of these buildings. Iran already has a number of observatories. Some of these observatories are robotic and autonomous. One of these is observatory of University of Kashan. Also, the Iranian National Observatory is a relatively large robotic observatory that is being constructed. We will continue to introduce the properties of these observatories.

### 2. ANCIENT OBSERVATORIES

#### 2.1. *Shahr-e-Goor observatory*

Shahr-e-Goor observatory is one of the most ancient observatories in Iran history (Fig. 1).

Professor "Dietrich Huff", German Archaeologist, in excavation of Firuzabad found a circle structures which after studying; it was found that this is the most ancient observatory left from Sassanian era (Ifonso 1970).



Fig. 1. Facing away from Shahre Goor. (Photo: A. Ameri)

Adobe and clay made astronomical benches which show months, are still perfectly in good condition. This have 65.5 meter diagonal and 12 marks of used sign in observational measurements and schematic benches. Probably these circular structures were in use for installation of sinusoidal device (Huff 1996).

#### 2.2. *Naghsh-e-Rustam observatory*

Naghsh-e-Rustam is name of a locale that stymie's in Fars province in south of IRAN. Solar

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Fig. 2. Building of the tower. (Photo: R. Taasob.)

observatory of Naqsh-e-Rustam is located in front of the crypts and is in short distance from Mountain (Fig. 2) (Bazoband 2013). From 1200 B.C. to 625 A.H. (1228 A.D.) this building was known as a sacred place.

Building of Naqsh-e-Rustam is a cube-shaped tower with a square base that is about 12.5 m tall and the length of each side is about 3.5 meters. In building of the tower only white and gray limestone are used, which have polished spectacularly and expertly placed close together and there was no need to stuff. On each of the three sides, eastern, western and southern of the building, six window-shaped solar indexes are seen which are made of gray stones. Changes in the angle between the edges of the solar indexes are equal to the changes of angle of the sunrise in various months of a year. The deep sides of solar cymbals are not perpendicular to other sides but there are slight deviations to adjust inner corners shadow. If there were not this little deviation so there would be no shades. Building of Observatory is located in a certain distance from the mountain so that it can observe sunrise in Summer Solstice beside the Eastern edge of the mountain and can observe sunset in autumnal equinox and vernal equinox beside the Western edge of the mountain. Northern steps of the building are 25 cm wide. These steps are masonry in the role of the plane degrees. Their duty is calculating the time by use of altitude of sun. Angle of gradient toward ground is exactly equal to angle between the highest and lowest altitude of sun in midday, (47 degree equal to  $83.5 - 36.5$ ) or in other words is equal to degree of distance of Summer Solstice and midwinter ( $23.5 + 23.5$ ) (Moradi Ghiasabadi 2001).

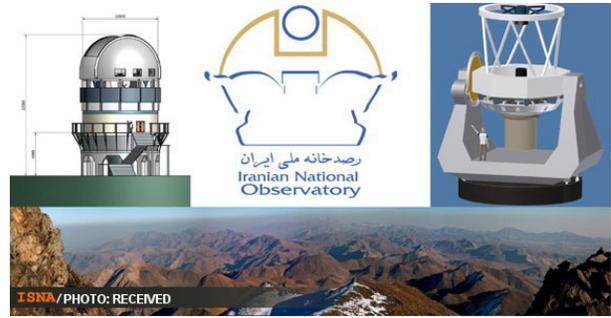


Fig. 3. Iranian national observatory Tower. (Photo: Received)

### 3. THE ROBOTIC OBSERVATORIES OF IRAN AND PROSPECTS FOR THE FUTURE

#### 3.1. University of Kashan observatory

One of Iran's robotic observatories is the observatory of the University of Kashan. The dome of this observatory is robotic and controllable. The main telescope of this observatory can be controlled by computer and internet, and its motion depends on the motion of the telescope, so this observatory can be controlled by internet.

#### 3.2. Iranian National Observatory (INO)

The plan for designing this observatory was introduced in 1999. After researches, 3600-meter high Mount Gargash in the Zagros Mountains is chosen for this observatory. The telescope with a 3.42-meter diagonal mirror is the first research telescope of Iran. This telescope will be installed on an Alt-Azimuth mount and with precise computerized controllers can lead it to arbitrary points. Sets of tools for record and evaluation or detectors for different uses such as photometries, recording camera, spectrometries, and polarimetries will be designed and produced. The system of tools that will be used in the National Observatory must be able to carry a telescope with a 60-ton weight with 0.01 arc seconds precision. In addition to software for controlling the motion of the telescope, the tower of this observatory is a cylinder with a 14.5-meter diameter and about 21-meter height (Fig. 3). This structure, which is so precise and complex, will be made of aluminum and other materials and will be compatible with the telescope and will rotate in both directions.

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