An Academic Astronomical Observatory in Djebel Orbata, Gafsa (Tunisia): A proposal toward dark sky exploration

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Abstract

The project of an astronomical observatory in Djebel Orbata, is an academic proposal that we aim to realize in partnership with national and international Universities, Institutes and research centers, to give the opportunity for students and researchers to continue their studies in the field of astronomy, as well help to implement astronomy and astrophysics courses inside Tunisian universities, remote future collaborative research projects and enjoy the low light pollution environment for science and exploration. The southern regions of Tunisia present very favorable conditions for astronomical observations because of an abundance of clear dark skies, which presents an ideal case for developing astronomical observatories, particularly in a desert environment.

Presently, astronomy is still absent inside universities in Tunisia. Thus, this project is a starting point to move the first generation of astronomers in Tunisia forward, share the culture of space sciences and astrophysics, and sensitize people regarding the importance of this field for the development of quality of education and the society.

For many years, there was little initiative to create an astronomical observatory or to purchase quality equipment for research, and part of it was due to the inability for the media to simplify this kind of science and connect it to the public and society. Since approximately 1981, the Youth and Science Association of Tunisia-AJST (Nabeul Club) in collaboration with some students from the Higher National Engineering School of Tunis-ENSIT, succeeded to build the first astronomical observatory in Tunisia (Fig.1). The selection of the observatory site was not very adequate, which ended up damaging the building because of high humidity. The observatory is currently not functioning, and it has been preserved as a historical monument for many years. The second tentative was by the Youth and Science Association of Tunisia-AJST (Djerba Club) in August 2018, where they succeeded to construct an observatory in Houmt El Souk, Djerba (Fig.2), under a very dark stunning sky and an easily accessible location. The astronomical observatory of Djerba is dedicated to outreach activities and public events.

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Fig.1. The astronomical observatory of Nabeul.
Coordinates:
36°26'16.97"N, 10°42'57.75"E

Fig.2. The astronomical observatory of Djerba.
Coordinates: 33°47'39.7"N 10°47'33.1"E

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Objectives

The project has two categories of objectives:

1.Scientific research:

•Introduce, supporting and implant Astronomy and Astrophysics courses in Tunisian Universities.

•Support thesis (Ph.D., Master, Bachelor) and research projects.

•Give access to researchers to do their measurements and observe Astronomical phenomena.

•Work in collaboration with the National Institute of Meteorology of Tunis.

•Offer a course for students, and give them the opportunity to use good equipment and develop their knowledge.

•Courses in research methodology and internship for students.

•Summer and winter school for researchers and Ph.D. students.

2.Outreach activities

•Share the culture of Astronomy, astrophysics, and planetary sciences in particular inside a university environment.

•Encourage students and children to study and explore more about the universe and the planets which are relatively close to us.

•Organize public events and observations, and present the importance of astronomy both as a scientific value and an economic opportunity.

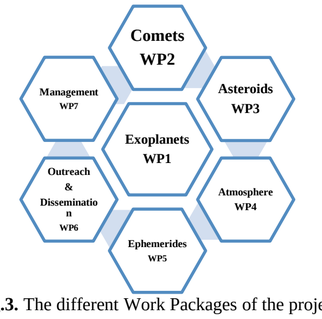


Fig.3. The different Work Packages of the project

WP1: Dedicated to the study of the exoplanets, discover and characterize planetary systems and earthlike planets around nearby stars, which provides an essential step forward toward the goal of discovering habitable planets and evidence of life beyond.

WP2: In this work package, we will study the comets, which are the remainders of material formed in the coldest part of our solar system. Some comets, could be a source of primitive life forms, e.g. bacteria, some comets are made of ice in which small particles from billions of years old, are included, and that provides insight into the history of the universe.

WP3: The biggest reason for this work package is to study and analyze the composition and the mineralogy of asteroids as they are considered to be the building blocks of planetary formation, and because some asteroids cross Earth's orbit every so often. And sometimes, they come very close to Earth itself.

WP4: Through this unit, we aim to study the Ionosphere, since it is constantly changing in response to the sun's activity and space weather. The Ionosphere plays an important role in atmospheric electricity and forms the inner edge of the magnetosphere. It influences radio propagation to distant places on the Earth and can cause disruptions to communication and navigation signals.

WP5: This package will be oriented to the study of eclipses, apparent retrograde motion/planetary stations, planetary ingresses, sidereal time, the positions of the mean and true nodes of the moon, the phases of the Moon, and the positions of minor celestial bodies.

WP6 and **WP7** will be specified for dissemination, outreach activities, administrative procedures, and management of the observatory.

Originality and innovative aspects

The complete absence of any professional astronomical observatory (Tab.1) or advanced astronomical facilities in Tunisia, for students and researchers, makes this project unique and attractive for some research centers, universities, and ministers.

	Location (Coordinates)	Date of creation	Equipment/Dome	Director of the Observatory	Participants / Collaborators	Type of Activity
Observatory of Nabeul	Nabeul, (36°26'16.97"N, 10°42'57.75"E)	1981	Empty dome without equipment	Habib Zangar	AJST Nabeul and ENSIT	Outreach
Observatory od Djerba	Djerba, (33°47'39.7"N 10°47'33.1"E)	June 2018	Ongoing Project : Dome + Mead 12" ACF LX200 Telescope	Lassad Akrout	ASJT Djerba and the Tunisian association "Afsil".	Outreach

Tab. The status of Astronomical Observatories in Tunisia

1.Location

Massif: Tunisian Dorsal
Coordinates:
34 ° 22 '50 "N, 9 ° 03' 23" E
Latitude: 34° 22' 49" N
Longitude: 9° 03' 23" E
Altitude: 1165 meters

The chain of Djebel Orbata extends over a distance of 60 km from the southwest to the northeast, and it's connected to the west by the Bouramli mountain range and from the east by the Bouhedma mountain range.

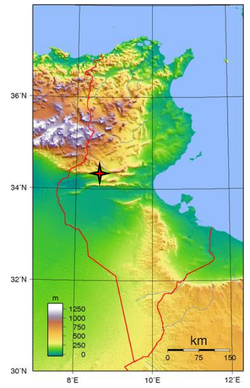


Fig.3. Topographic map of Tunisia (T.Sellami et al., 2017)

2. Light Pollution and dark Sky

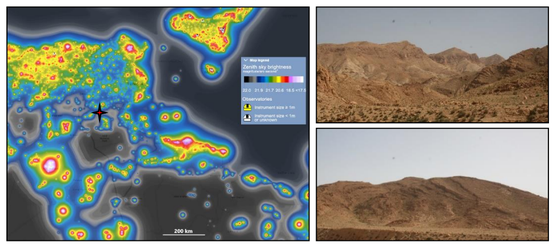
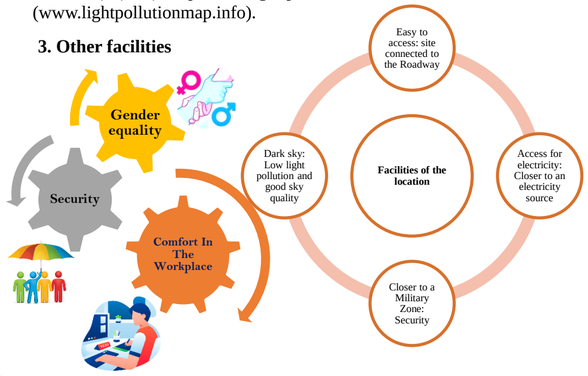


Fig.4. (Right) Images of the selected site in Djebel Orbata ((C)Raouf Kaabachi). (Left) Map of the light pollution for Tunisia (www.lightpollutionmap.info).

3. Other facilities



Expected results and risk

Through the Astronomical Observatory in Djebel Orbata, we pursue to collaborate with several Universities and Faculties inside and outside Tunisia to benefit from institutes that have prior and better experience in such a project. We aim, also, to coordinate this project with the Ministry of Higher Education and Scientific Research, the Ministry of Education, and the Ministry of Youth and Sports in Tunisia, especially that the idea is new and unique in a country where astronomy is absent.

Among the qualities that this project will offer is:

•Contribution to research and scientific programs. We are estimating to have around 15 to 20 thesis projects per year.

•Improve the quality of education, leading to other research projects and international collaborations.

•Promote an exchange program for students and researchers between Tunisia and other countries to develop their skills, knowledge and gain new experiences.

•Allow astronomers and researchers to work with good equipment remotely or on site, to enjoy the dark and quiet Sky in Tunisia, especially for countries lacking a good sky quality.

•Improve access to foreign students and researchers to continue their research studies and measurements.

Party:* *Project will offer	***Counterparty*** Partners will offer
• The location/land for the observatory. • Part of the budget and expenses of transportation. • Local support/working team. • Good quality of the night sky. • Opportunity to foreign students and researchers to use the equipment, learn new knowledge, and have new experiences. • Create an extended network and remote new collaboration for future projects.	• Scientific support and direction for research projects. • Helping to implant university courses and give advices from previous experiences. • Help to promote exchange programs for students and researchers. • Possible help with equipment and funding. • Support students training in outboard observatories and internship.

The particular risks to the project might be:

•The loss of specific beneficiaries/partners and the loss of essential knowledge or experience,

•Failure to recruit.

•Failure in compliance with the project's work plan in terms of delivery date or quality.

•Failure to acquire an adequate budget.

•Failure to acquire a site/location/property for the observatory.

•Problems in the transportation of the equipment to Tunisia from abroad.

References

[1] M.El Yazidi., I.Titouhi., R.Ben Nessib., W.Jomni., R.Hamdeni., K.Segni., L.Jardak., Y.Tahri., A.Bhief., L.Akrout., S.Elouati., A.El Fadhel., A. Zribi., T.Basly., A.Bachtobji., M.Hassiki., M.Zied., S.Ben Hadj Slimene., O.Mannai. IAU CAP Conference. (2021) **[2]** M.El Yazidi., N. Slim Shimi., N. Laridhi Ouazaa., S.Debei. 30th General Assembly of the IAU.FM15.140.(2018) **[3]** The report of the International Year of Astronomy (IYA 2009).

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3-7 October 2021