



The TACOR educational telescope and the Italian RemoteLab Project Learning tools for the International Year of Astronomy 2009

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The Department of Physics of *La Sapienza* University has installed a didactic remote controlled telescope (TACOR) which, in collaboration with the Department of Physics of University *Roma Tre*, is currently used in mid-level and high-schools classes.

The TACOR telescope operate in the framework of the National RemoteLab Project which is supported by Italian Ministry of Public Education. During the forthcoming International Year of Astronomy 2009 TACOR and RemoteLab will be powerful on line tools for an interdisciplinary approach to teaching and public communication of Astronomy .



The "Telescopio a Controllo Remoto" (TACOR) [1] is located on the top of the Physics Department of Roma University *La Sapienza* and operate in the framework of the National *RemoteLab* Project. The telescope can be controlled directly from the schools through an ADSL internet connection. A live netcam allows the remote observers to follow the telescope operations.

Location	Roma, Italy (long. 12 31 03 E; Lat. +41 54 05 N)
Mount	Bellincioni Omega
Motors	Astrometric Skywalker
Main telescope	Celestron Schmidt-Cassegrain, diameter 235mm f/10, camera Meade LPI
Auxiliary telescopes	Coronado PST40, H-alpha filter, webcam Philips Toucan Pro II
	Viewfinder Celestron 50 mm f4, webcam Creative EX Pro
	Viewfinder Yashica 135mm f2.8, camera Mintron WTW-12V1C-EX

All the cameras and the telescope mount are controlled by a PC under Windows XP. Pointing is performed with the electronic planetarium software Perseus.

Remote control is made with the freeware software VNC available for Windows, Linux/Unix and Mac OS.

Up to now TACOR has revealed itself an efficient way of teaching and learning Science with great interest of students and teachers. During remote connections from the schools the observations currently performed are the following.

Daylight :

Sun:
The PST40 telescope allows the vision of nearly the whole solar disk in H α light; solar prominences are clearly seen, as well as the sunspots.

Moon:
The viewfinder has a field of view of about 2°, allowing to see the whole Moon: the measure of the Moon diameter is possible and observations at different dates show the apparent diameter variations.

Venus:
The Celestron telescope shows the phase of Venus, so it is possible to repeat Galileo's observations of the phase changes, demonstrating that Venus is in orbit around the Sun.

Night observations:

Moon
The Celestron telescope allows the observations of the Moon craters down to 4 km diameter. As in the case of daylight observations, the view finder allows a measure of lunar angular diameter with a relative error of about 3%.

Planets
Measures of the major planets diameter can be easily made through the Celestron. The different colors of the planets are clearly shown. The satellites of Jupiter and the rings of Saturn are quite evident.

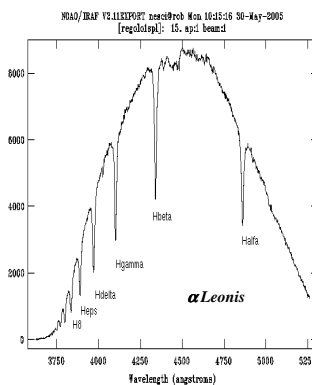
Bright stars
The atmospheric seeing is well evident in the star images, as well as optics misalignments. Star colours can also be detected, quite remarkable for some double stars. Measures of angular separation can be made on the images.

Recently the National Television RAI produced an educational video about TACOR which has been broadcasted on the RAI-EDU Channel. The video is available on the web [2].



Physical, chemical, geological, biological, technological evolution of the Cosmos

During thousands of years of cultural evolution the presence of the starry sky has been the environmental condition that more determined the psychic and intellectual structure of human mind. Also today, although the sky has been extinguished by the indiscriminate light pollution, Astronomy remains a powerful stimulus for the intellectual curiosity of the persons and in particular of the children [7]. Moreover modern Astrophysics involve many topics in common with all Natural Sciences and Mathematics. Therefore Astronomy is very useful for *formal and non formal* interdisciplinary learning of the sciences. During the forthcoming IYA 2009 the TACOR telescope and the RemoteLab will be powerful tools for communicating astronomy in the interdisciplinary context and to promote among the Public the evolutionary image of the Cosmos and of biological life.



RemoteLab [3] is an opportunity offered to all Italian schools for studying different physical, chemical and biological phenomena by means of true, not simulated, remote experiments freely accessible through a dedicated web site [4].

The experiments are placed in different sites: Bologna, Caserta, Milano, Roma, Torino. The system is mainly based on Leybold Didactic [5] control hardware and on the software Cassy Lab. The web site has been designed and is managed by Didattica Italia.

Contribute to the project the following institutions:

- Department of Physics, Torino University
- Life Learning Center, Bologna University
- Department of Physics, University Roma Tre
- Department of Physics, University La Sapienza, Roma
- IPSIA A. Righi, Santa Maria Capua Vetere, Caserta
- National Association of Technology Teachers (ANIAT)

The experiments:

- Remote Nikon Coolscope [6] Microscope
- Tacor Telescope
- Acid /base titulation
- Centrifugal force
- Black Body Radiation
- Diffraction and interference of ultrasonic waves
- Lorentz force
- Electromagnetic induction
- Basic electronic circuits



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