Robotic telescopes and their use as an educational tool

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Abstract
Robotic telescopes are new tools that are changing many aspects of the way we do astronomy. The use of this type of telescope has been quickly adopted in some of the most prolific fields of this science, including searches for extrasolar planets. In this particular field, robotic telescopes have demonstrated an efficiency and agility that would hardly have been obtained with conventional telescopes. In addition to the typical scientific uses, robotic telescopes are being used as fundamental pieces in the practical education of astronomy. Numerous institutes and museums have begun to develop their own robotic telescopes to bring astronomy into the classroom; as a way to understand the Universe that surrounds us. By establishing collaborations between institutes in different countries observations can be made in the classroom without a change in school schedules, which has an enormous benefit to the education community.

The robotic telescope concept
Robotic telescopes are a new tool for astronomy. They are mostly destined to study nearby and brilliant objects but are perfect to support experiments that require constant monitoring of the sky. Also, robotic telescopes are very useful in routine observations that do not require an operator and for which a great amount of data is generated but can be reduced and analysed automatically.

Robotic telescopes in action
Taking advantage of the flexibility and versatility that characterise robotic telescopes, these instruments have become one of the most important tools in practical education and the teaching of astrophysics. They are a way to reach the public rapidly due to their particular configuration and the technical innovation that they represent. Impressive images and scientific results in top astrophysics are good examples of their potential.

Science with robotic telescopes
The study of extrasolar planets is in the vanguard of the present investigation of astrophysics and is of great interest to the field of astrobiology.

The method of transit detection is based on obtaining differential photometry to detect changes in the light curves of stars. For this type of study a great amount of observation time is required.
Robotic telescopes are very useful for discovering new bodies in the Solar System or tracking already discovered objects, in particular near Earth objects (NEOs). The study of NEOs is fundamental to increasing our understanding of the rates of impacts on planets, something clearly linked to the origin and the evolution of life.

The study of stars similar to the Sun is also important (particularly in terms of astrobiological implications) and has benefited from the use of these telescopes. A study that covers a wide range of star ages and metallicities can provide data that allow us to determine their zones of habitability. Photometric analysis of these stars will connect the microvariability with the chromospheric and magnetic activities of our star.

Systematic observation projects cover an important part of the time of observation with robotic telescopes, such as: search for extragalactic supernovae, astrometry of comets and asteroids, variable star and binary eclipsing photometry. Also, time is dedicated to targets of opportunity like novae, supernovae and gamma ray bursts.
Robotic Telescopes and their use as an educational tool

CAB’s robotic telescopes
The Spanish National Institute of Aerospace Technique, encouraged by the Centre of Astrobiology, promoted the creation of a network of three robotic telescopes, one in the Observatory of Calar Alto, one of the best astrophysical observatories, another on a mountain near Calatayud and a third in the campus of INTA. The three telescopes have a classic Cassegrain configuration, with an aperture of 40-50 cm and motorised and automated equatorial mounts and domes.

Astronomical sessions
In order to introduce astrobiology to the public, visits to the Centre of Astrobiology and its robotic telescopes are organised. During the past year the telescopes have been improved and are ready to begin a programme of visits that include astronomical observations. We will try to initiate the activity next winter, as we have several education centres that have already shown interest. The observation sessions, lasting between two and three hours, will consist of a guided visit to the installation, a talk about robotic telescopes and their use and finally the night observation that will include the viewing of several astronomical objects visible that night like globular clusters, planetary nebulae, hydrogen nebulae, galaxies and bodies of the Solar System.

Observation programmes
The planned programme of astronomy sessions is only an example of a much more ambitious project that includes a programme of direct observations and a complete educative project with practical sessions in the classroom. By means of this programme students will be able to make remote observations on subjects of general astrophysics that they themselves have prepared and requested. After the observations, they will have to analyse and report their results, receiving support and advice from the scientific staff of the CAB.