

## Using the Net for Education and Outreach in Astronomy

Leopoldo Benacchio

*Osservatorio Astronomico di Padova, Vicolo dell'Osservatorio, 5-35122  
Padova, Italy*

**Abstract.** This paper consists of two parts. In the first is briefly described the “Catch the Stars in the Net!” education and outreach via the Internet project, giving also an account of some important lessons learned about the way the Network changes the rules of the game. In the second part the special Web module “The Universe at Your fingertips,” developed for visually impaired and even completely blind Web users, is described.

### 1. The Catch the Stars in the Net! Project

Catch the Stars in the Net! is an education and public outreach program carried out by the Padua Astronomical Observatory, with the support of the main Italian telephone and Internet Company: Telecom Italia. The Project is in fact based on the Web and the so-called “new technologies” of communication (international edition<sup>1</sup> or the Italian one.<sup>2</sup>

A new working method, more complex and time consuming than the traditional one, but also more interesting and rich in results was adopted. The project produces the Web site, but every initiative, studied and realised by the astronomers, is first of all proposed to a focus group. Typically, we use schools if education is concerned, and a group of “typical” users for public outreach. The initial version is given to these users, from which suggestions, criticism, and suggestions are collected and used for the production of the final release. Only after this procedure, a module or an initiative becomes public in the Web site.

In other words, the Web site only represents the “visible” part of a more complex project of education and popularisation of our Science. With the site, we want to satisfy the interests of the Internet surfer who wants to learn some astronomy concepts, or who is simply curious about these themes. At the present, several levels are satisfied: from Primary School children to Secondary School students, to adults who want to “know more” about the sky.

The Project received awards from the public and the critics (e.g., 1998 New Media Prize; 1999 Kidscreen Digital Kids).

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<sup>1</sup><http://www.astro2000.net>

<sup>2</sup><http://www.lestelle.net>

## 2. The Website

The site is composed of educational or popular “modules,” organised in different levels of complexity and depth, in order to meet the specific interests of the user. The site is accessible to everyone, but each module is designed with a particular user in mind (i.e., teachers, students, less than 10 years old children, teens, curious and simply interested). A careful modality of exposition of contents and themes (i.e., education, outreach, history, curiosity/news, and communication) is used in the design of the site.

The interaction and collaboration with the public and, above all, with schools (students and teachers) is very important during all the working phases. Thanks to this collaborative work we are also able to understand future directions and extensions of the Project. *Catch the Stars in the Net!* takes advantage of the potentialities offered by the so-called new technologies applied to education and popularisation. The topics covered and the methodology of exposition have been carefully studied and realised, according to the possibilities of the Net, with the aim of making the site educationally valid, but at the same time interesting and fascinating for the user. Multimedia, interactivity, and hypertext have in fact given their contribution to the creation of the Web Site. In this way, even if rigorous in content and innovative in the teaching method, the site is very attractive and stimulating for anyone who wants to know astronomy or simply has some curiosity about it.

For what concerns teaching, we have to say a word about the Virtual Planetarium, a module of the Project that is nowadays an example and reference in the teaching of sciences via the Internet in our country. The Virtual Planetarium is in fact used by a lot of schools in their scientific curricula and by individuals. Using this site as a real interactive course of astronomy, students can experience a new way to learn. It is a lively way that surpasses the traditional limitations of texts. This gives the opportunity to learn the arguments following a favourite way and with an adequate rhythm to individual capabilities. You learn by yourself—that is a very good way to learn.

The site isn't static, but follows the continuous growth and evolution of both astronomy and new computer technologies, making necessary frequent updates of the contents. At present, between various initiatives that are accessible to everyone, we have on-line:

a) *The Virtual Planetarium* is an interactive astronomy course via Internet for 10–18 years old students. It contains 27 educational chapters, in which there are the main themes of astronomy, from the Earth and the theory of gravity to stellar evolution and cosmology. The course contains more than 800 text pages, hundreds of pictures, movies, and animations, and also virtual experiments, all specifically build for the project. The Virtual Planetarium can be used as a self-learning tool and as an aid to teachers who can adapt it to the scholastic curriculum and to the peculiarity of each class of students. The chapters are independent, so that they can be explored one by one and then appropriately inserted in the annual curriculum. A peculiar teaching method is used in the teaching of Science (Karplus Cycle), by cutting a priori misconceptions. Wide space is given to the “teacher page,” containing the experiences of teachers that have adopted the Virtual Planetarium in the scholastic curriculum.

b) *Voyage into the Cosmos: from Galileo Galilei to Interplanetary Probes* is the Web server of the astronomical exposition, which took place in Padua and Rome in 1997, and which had more than 70.000 visitors in six months. The site contains a great exposition of many items of the modern astrophysics and a view of current astronomical instruments. The history of the most important astronomical discoveries, from Galileo to the present, as well as the main missions of cosmic exploration is covered. A particular part is given to the so-called “new astronomy,” that is the observations in non-optical spectral bands, the research about neutrinos, gravitational waves, and cosmic rays.

c) *Ask the astronomer*, where the user can ask an astronomer every kind of question, using a simple form. The answers are collected, argument by argument, in a proper page. The user is tempted in this way both to visit the site often and to collaborate actively in its development.

d) *Request a videoconference (initiative for Italy only)*. This initiative, completely free to the user, offers the possibility to schedule a videoconference about a fixed theme or by “question-answer” according to his requirements.

e) *Astronomy for all (initiative for Italy, some parts also in English)*, initially born as a deepening of *Voyage into the Cosmos*, consists of two sessions dedicated to different users. The first is *Starchild*, adapted from a NASA initiative and dedicated to 6–14 years old children. There are few basic concepts (gravitation, appearance and morphology of planets, etc.) with suitable and selected pictures. The second is instead dedicated to people who want to “know more.” This site offers a rigorous and deep view about all the themes of modern astronomy. There are a lot of pictures and movies coming from NASA, Hubble Space Telescope Institute, and other famous scientific institutes.

f) *The Specola Museum: a tour to the Observatory (also in English)*. The building in which our Observatory is hosted is an ancient tower raised in 1117. At first it was a castle, and then a fortress for hundreds of years. In 1767 the big tower became an Astronomical Observatory. In this site you can read the history and make a virtual tour of what is still considered one of the finest Observatories of the 18th century.

g) *Under the Moon shadow (soon translated into English)*, completely dedicated to eclipses, and particularly to the one of August 1999, this site was created to satisfy interest about this astronomical event. The contents included 1) information about “when and where” the eclipse will happen, 2) “what happens and what to see” during the phenomenon, and 3) “how to observe and to take pictures” in safety. There are also many pages about the origin of eclipses, as well as interesting historical information, ancient myths and legends about them.

h) *Constellations on the Net (soon translated into English)*, is dedicated to the 88 official constellations and shows their characteristics and other information about them. Maps, visibility time from Italy, position, mythological history, and information are given for every constellation. There are also pictures by which the users can learn to distinguish them on the sky.

i) *Serravalle’s clock* describes the surprising discovery of a tower clock dial of the 14th century, in 1993 during the repair of the “Torre Campanaria” (Main bell tower) of the Municipal Palace in Vittorio Veneto (Treviso-Italy). The goal is to spread this discovery and simultaneously to stimulate the user’s interest

toward other themes, objects of future developments such as the “time” and the periodic astronomical phenomena used in its measure.

### **3. The Sky at Your Fingertips!**

In the project website, the first scientific outreach Web site completely aimed at visually impaired users of the Net is now available. The only one at this moment in the Net, the site is a classical journey around planets, comets, and galaxies to discover the wonders of the Universe. A main characteristic of this part must be stressed: this site is not “adapted for” or “accessible to” visually impaired or blind people, but it is especially developed for these users. Each page contains an astronomical image, a professional one, converted to tactile form, which may be printed through a Braille printer, and a detailed description of the image itself. The conversion is made by means of a piece of software developed at the Department of Electrical and Computer Engineering at the University of Delaware (see <http://www.ece.udel.edu> for software and literature). Images can be produced in a tactile format on paper via an embosser, a typical hardware for visually impaired people that allows the user to print in Braille format. While touching the printed image the user can listen to the textual description via a vocal synthesiser, a hardware or software device generally present in the PC’s used by blind Internet users.

The site contains an overview of sky objects: the Sun and Solar System planets, stars, and galaxies. The physical phenomena associated with the chosen astronomical image are also included. The functional texts, that are linked to the images, are easy and clear, and they are the description of the tactile images rather than a standard explanation.

The co-operation of a blind person has been essential to the implementation of this site, in order to overcome, rather than technical problems, many specific ones arising from the different way blind people perceive distance, depth, size, and shape of objects.

“The Sky at your Fingertips” is a small contribution towards the philosophy of Web design for all. The site, also available in Italian, can be considered as the first experiment of its kind, and we are going to improve it according to the users’ suggestions.