VIRTUAL OBSERVATORY FOR EDUCATION

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IVOA & EuroVO

The **Virtual Observatory** is an international astronomical community-based initiative. VO aims to allow global electronic access to the available astronomical data archives of space and ground-based observatories and other sky survey databases.

The **International Virtual Observatory Alliance** (IVOA) facilitates the international coordination and collaboration necessary for the development and utilization of the VO.

EURO-VO aims at deploying an operational VO in Europe. It supports the utilization of VO tools and services by the scientific community, technology take-up and VO compliant resource provision, and building of the technical infrastructure.

EuroVO FOR EDUCATION

WHY

- Bring science to students and get them engaged
- Give students an involving glimpse of the professional world of astronomy, including a perception of the infrastructure
- Make them realize they could become scientists
- Teach some elements of astronomy

HOW

- Use VO resources
- Adapt/simplify key tools (with user's help)
- Provide a library of use cases
- Propose activities that mix "serious work" with "fun"
- Train teachers, engage students

SOFTWARE

- Professional (e.g. Aladin) or popular (e.g. Stellarium) software custom modified following teacher and student suggestions
- Software translated in several languages (still searching for volunteers)
- Stellarium now can access the SIMBAD database
- Aladin is available in a “undergraduate” version
- Aladin allows search for objects by class
- … and more

USE CASES

1. **The sky** - *basic*

Within this use case you discover the celestial coordinates allowing you to point and/or find a given star in the sky. You also learn how to use coordinate systems in order to learn the effects of Earth's rotation and revolution on the celestial sphere. Special topics are constellations and light pollution, both important for a basic appreciation of the night sky.

2. **The stars** - *intermediate*

Within this use case you discover the basic observational parameters of stars, color and magnitude. These observational parameters are counterparts of the main physical parameters temperature and luminosity. By selecting stars on the sky you build the Herzsprung-Russell diagram that shows the relation between color and magnitude, a milestone in the history of our understanding of how stars work and evolve.

3. **The shape of galaxies** - *basic*

Within this use case you discover the shapes of galaxies and their classification according to the Hubble diagram. You are offered sequences of galaxies with different morphologies and are asked to order them. The morphological classification of galaxies is still in use even if we have discovered that the Hubble diagram "per se" has no direct physical or evolutionary meaning. Besides introducing the main shapes of galaxies, the use case offer a demonstration of the classification process, a fundamental tool of astronomers.
* download a galaxy set: hubble_1.zip, hubble_2.zip, hubble_3.zip, hubble_4.zip

4. **The Pleiades open cluster** - *advanced*

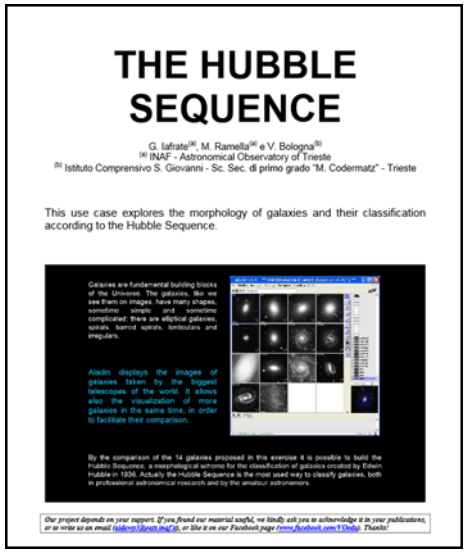
Within this use case you recognize a physical association of stars close in space as opposed to a superpositon created by projection effects of stars very far one from the others. The key measure is distance derived from parallax. With the true members of the association (open cluster) you create a Herzsprung-Russell diagram as in use case 2. The Herzsprung-Russell diagram of stellar clusters is very important because of the low noise of few unrelated stars.

5. **Proper motion of the Barnard's star** - *intermediate*

Within this case you learn that stars that seem "fixed" on the sky may actually move, even if their motion is so slow for the naked eye to be undetectable. You compare two photographs of the Barnard's Star taken several years apart and will be able to estimate its displacement on the sky. Your estimate will be very close to actual measurements.

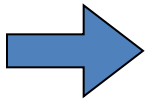
6. **Confirmation of an apparent supernova** - *intermediate*

Within this intermediate use case you learn about supernovae (see also use case 8.)and determine the celestial coordinates of a just discovered candidate supernova (see also use case 1.) on an image (provided) that has no coordinate systems. This use case provides a glimpse of an activity that is representative of the practical tasks that astronomers have to perform when they analyze data.
* download the image ngc6946.fits



USE CASES

- Developed with the contribution of teachers and students
- Available in several languages
- General presentation of the astronomical problem
- Step by step guide on how to use the VO software tools needed to solve the problem
- “To measure” is a key activity in science: exercises

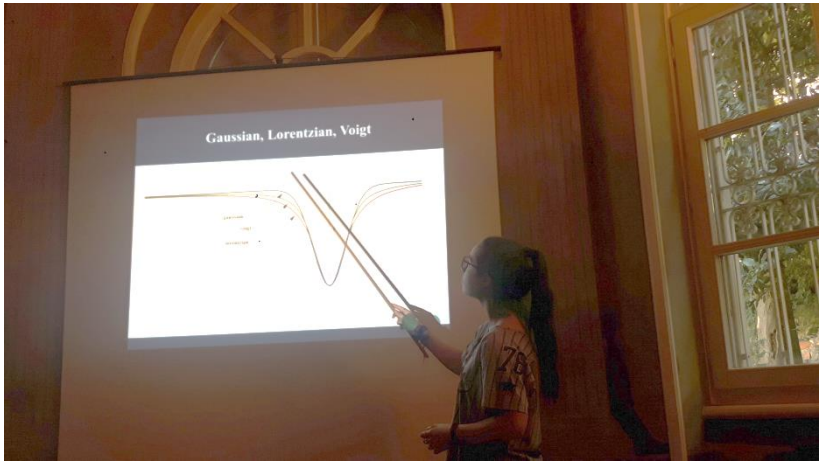


Examples: exploration, astrometry, photometry

RESOURCE REVISION BY STUDENTS

Use cases and software have been revised in the last school year during an intense program with high school students, in the framework of the H2020 ASTERICS project.

We thank Alessia Canelli, Karin Cescon, Dimitri Francolla and Asia Micheli, from liceo scientifico G. Galilei in Trieste, for the review of this use case done in the framework of the european project Asterics (H2020).



TARGET AUDIENCE

- Each school-year we work out our VO use cases with about 500-600 students (ages 13-18) coming to our institute
- We teach a University class in observational astronomy based on VO
- We organize workshops, VO-Days and conferences dedicated to teachers who want to work with VO in their schools
- We teach in schools for young researchers and astronomers, all around the world (Brasil, South Africa, Slovenia, Romania, …)



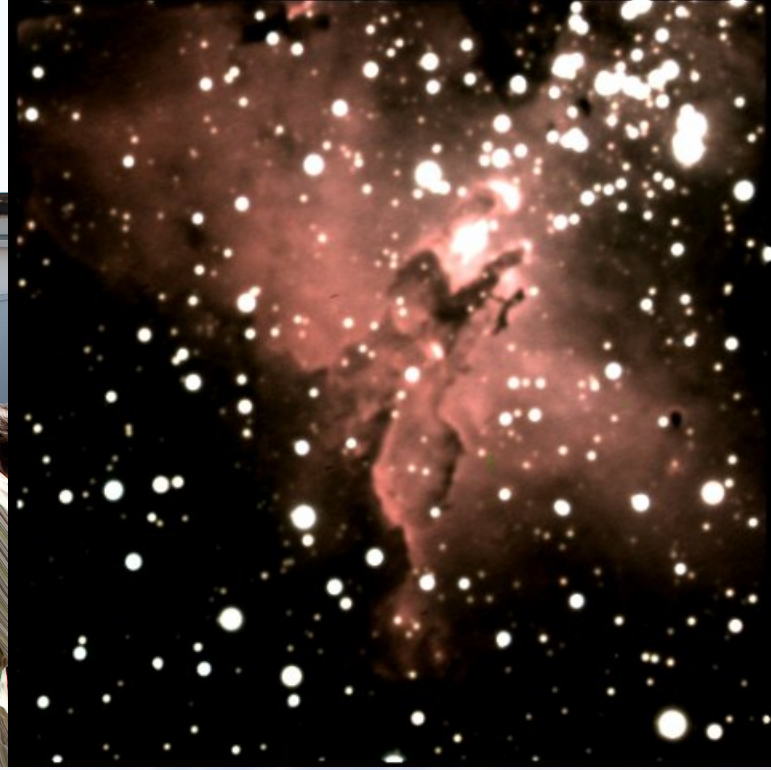
STARS GO TO SCHOOLS (SVAS)

Two educational telescopes, for night observations (stars, nebulae, galaxies, planets) and solar observations

SVAS telescopes can be managed remotely by students from school or from the Esploracosmo laboratory at our institute

SVAS telescopes are requested by schools from Italy, nearby countries but also (e.g.) from Japan!


ASTROTECH

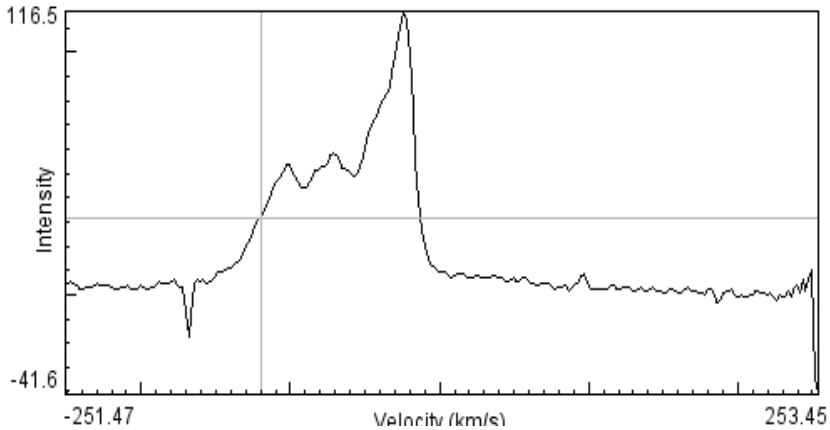


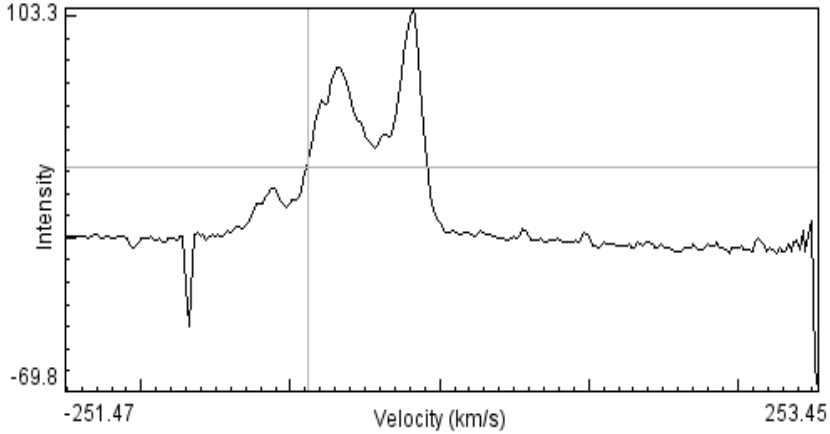
ESPLORACOSMO LABORATORY

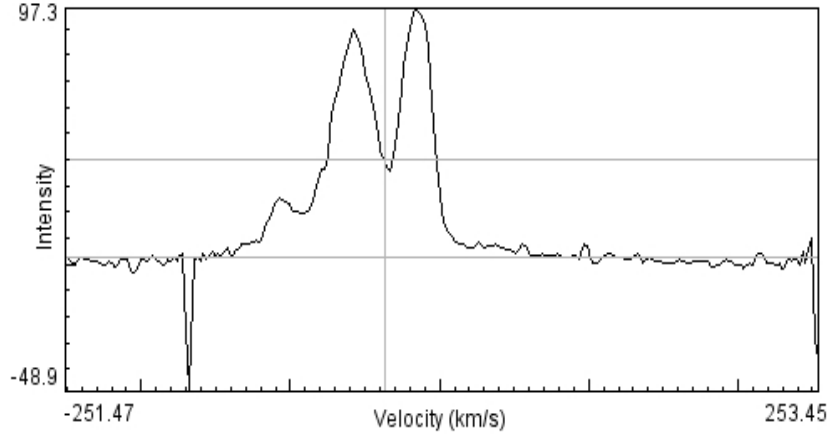
In Esploracosmo we combine real (remote) and virtual observing:

- images from SVAS telescopes
- Images from other robotic telescopes (e.g. Salsa @Sweden)
- tools and data from the VO
- images from our local archives

Students can not only take images by themselves but, most importantly, they can **analyze data using VO tools**







EU-HOU Bringing frontline interactive astronomy to the classroom

ONSALA (Sweden) radio telescope

ITALY: VO EDU ON A NATIONAL WIDE SCALE

Ministry of education funded a national project for astronomy education and outreach, led by INAF

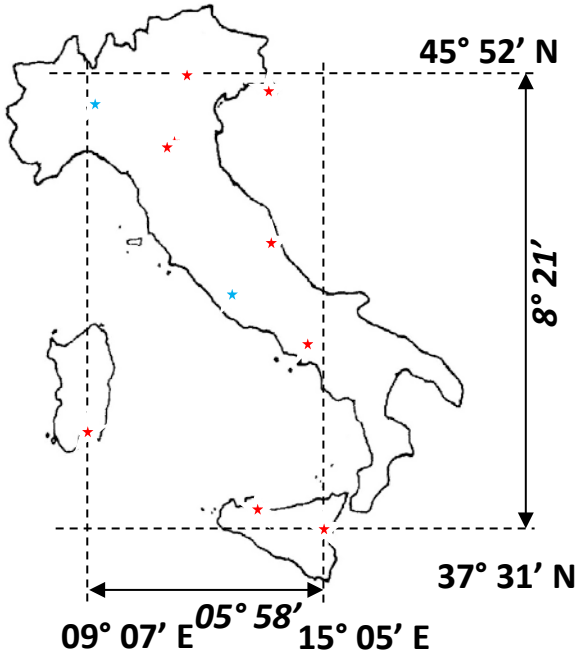
VO and **remote telescopes** are two of the main pieces of the project

VO

- diffusion on a national scale increasing the number of schools and students using it
- diffusion through workshops for teachers organized in several cities

REMOTE TELESCOPES

- IRNET – Italian Remote Network of Educational Telescopes



IVOA EduIG

A two-way communication channel between the public and VO

Twiki page and mailing list: tools for sharing practices, materials, information, ideas, for finding or requesting help

Activities:

- SVN repository for Edu resources
- VAPE
- EDU registry

To join the group and subscribe to the mailing list visit:
http://www.ivoa.net/members

CONCLUSION

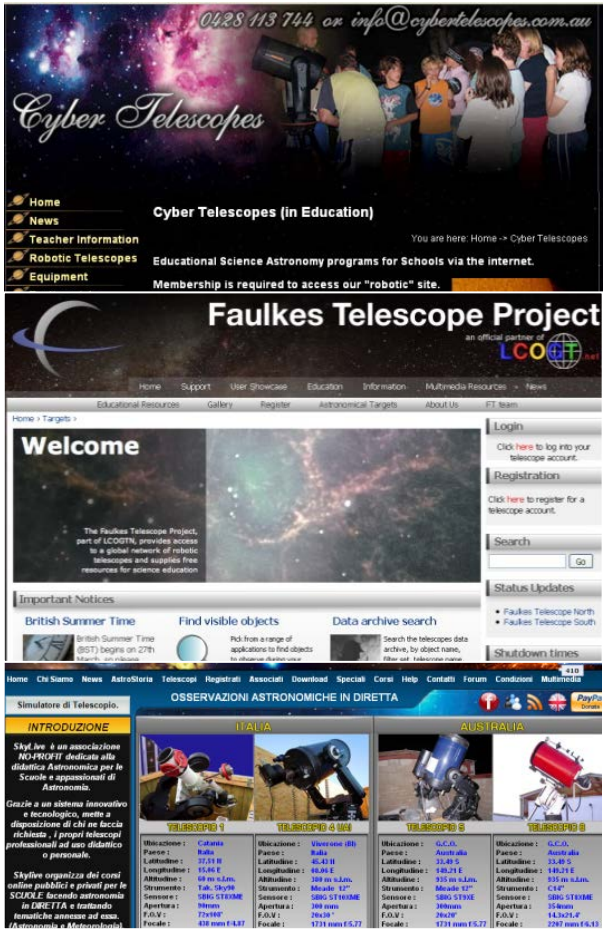
Many remote educational telescopes are now available around the world

The VO is growing also

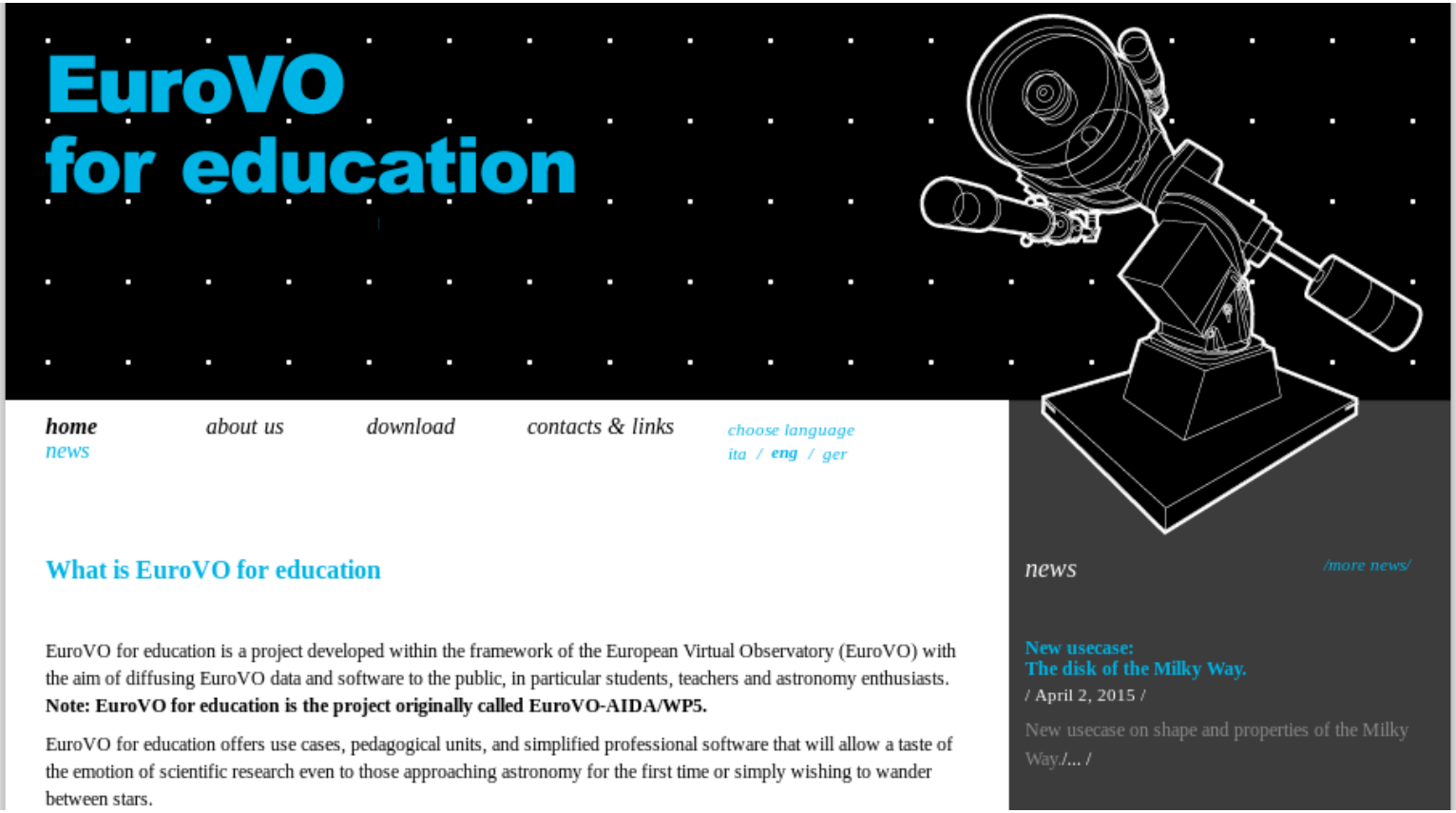
We think VO and remote observing is the winning combination for astronomy education

Teacher and student feedbacks confirm it

We aim to a wide diffusion



VO FOR EDUCATION WEB SITE



http://vo-for-education.oats.inaf.it

THANK YOU!

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