The Universe for everybody: a journey through astronomy public engagement

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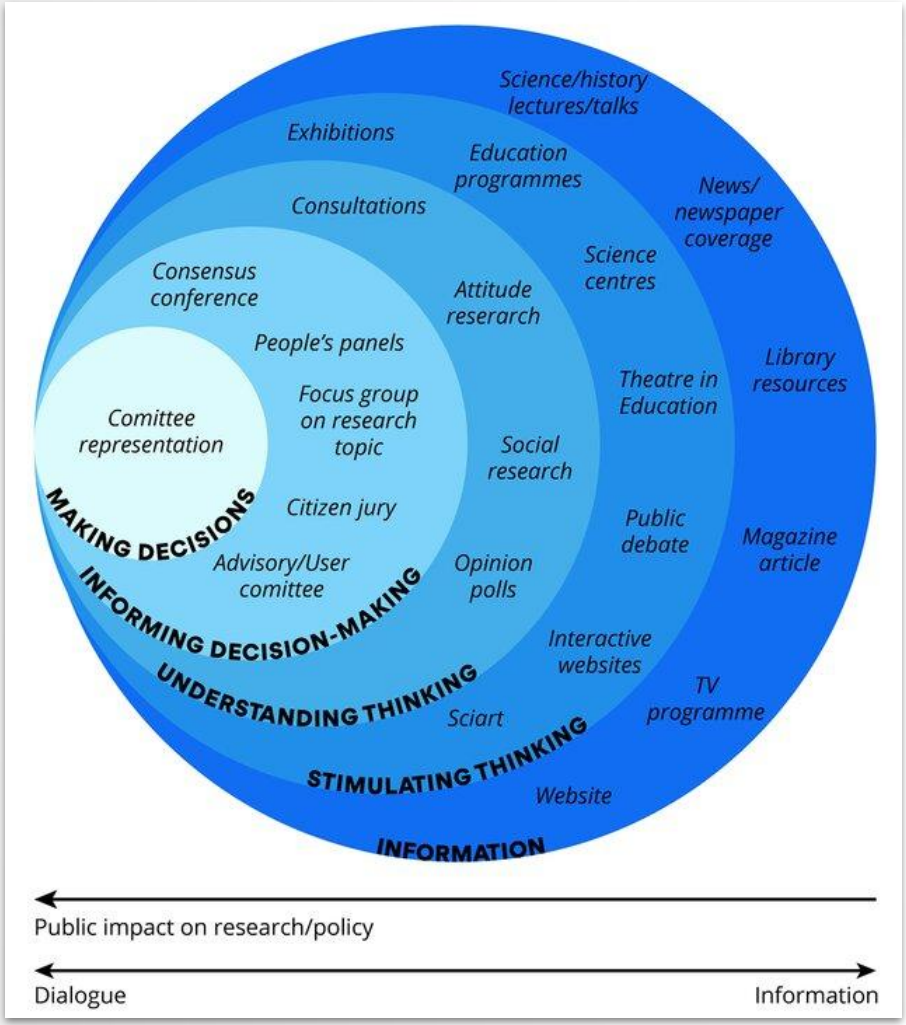
1st Astrophysics in the New Era of MM Astronomy International Conference - Poços de Caldas, Brazil - 8 December 2023

Outline

- What is public engagement?
- Outreach products from science communication campaigns: Rosetta, Gaia
- Educational resources: INAF Play & Univers@LL
- Astronomy for development: Closer to the Sky project in Rio de Janeiro
- Art & science: A Sign in space



The "public engagement onion" model

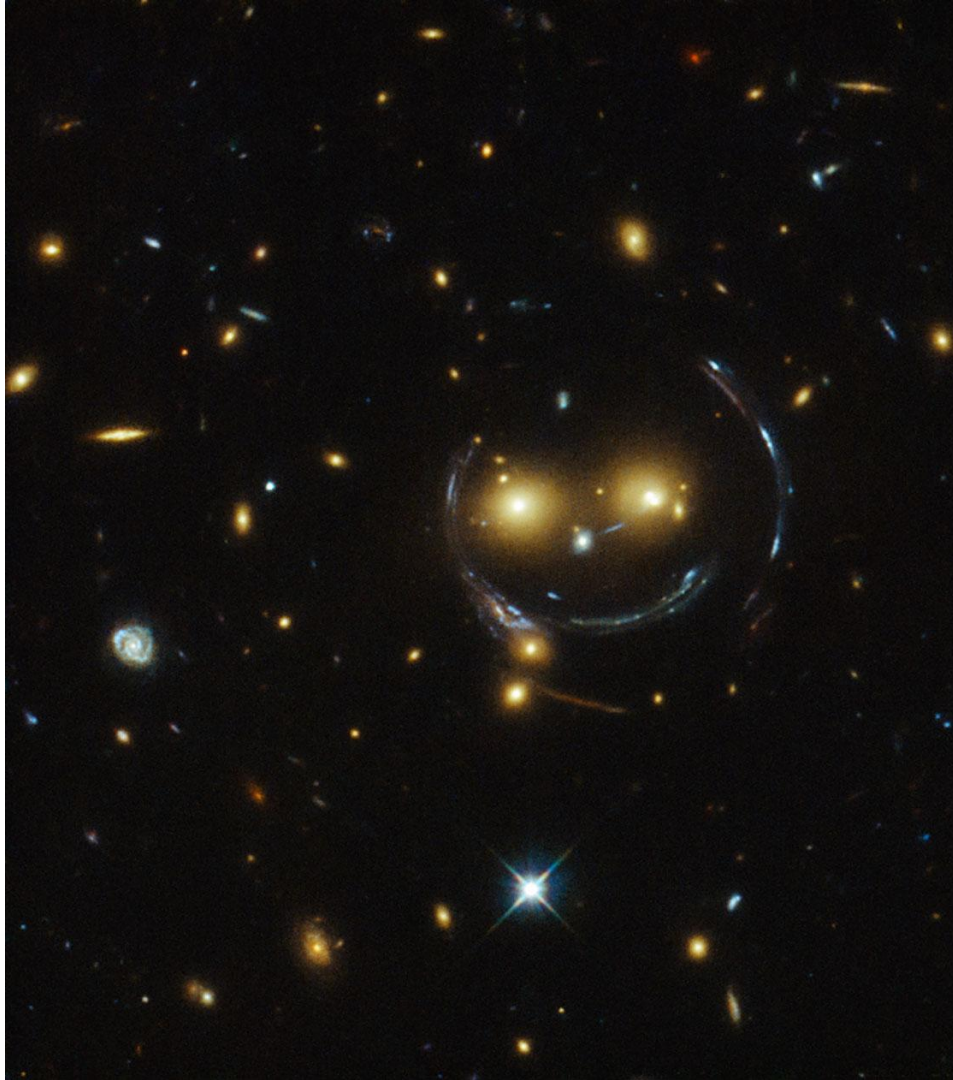
Credits: Wellcome Trust

“Science is not finished until it's communicated”

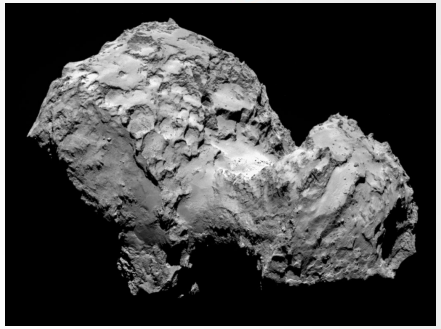
Dr Mark Walport,
former chief scientific advisor to the UK government

“Research not communicated is research not done”

Professor Anne Glover,
former chief scientific adviser for Scotland and for the European Commission

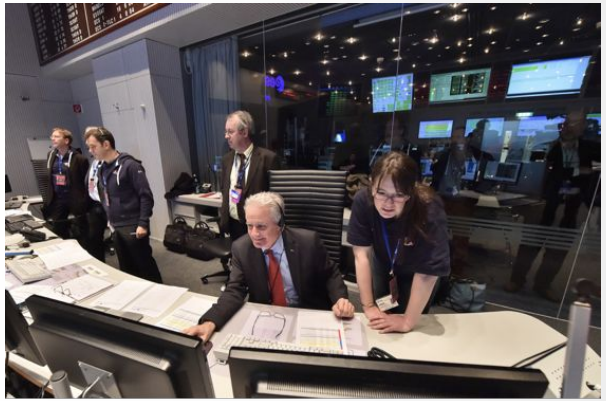


The Rosetta mission comms campaign



Communication strategy:

- Open and transparent communication during key operational phases
- Communicating risks as well as excitement
- Make it “personal” to people



Products:

- Institutional communication, press events
- Dedicated blog
- Social media:
  - first-person Twitter account
  - public contests
- Cartoon series
- Science-fiction short film

Storytelling on Twitter

Baldwin, Mignone et al. (2016)
Communicating Astronomy with the Public Journal

Storytelling on Twitter

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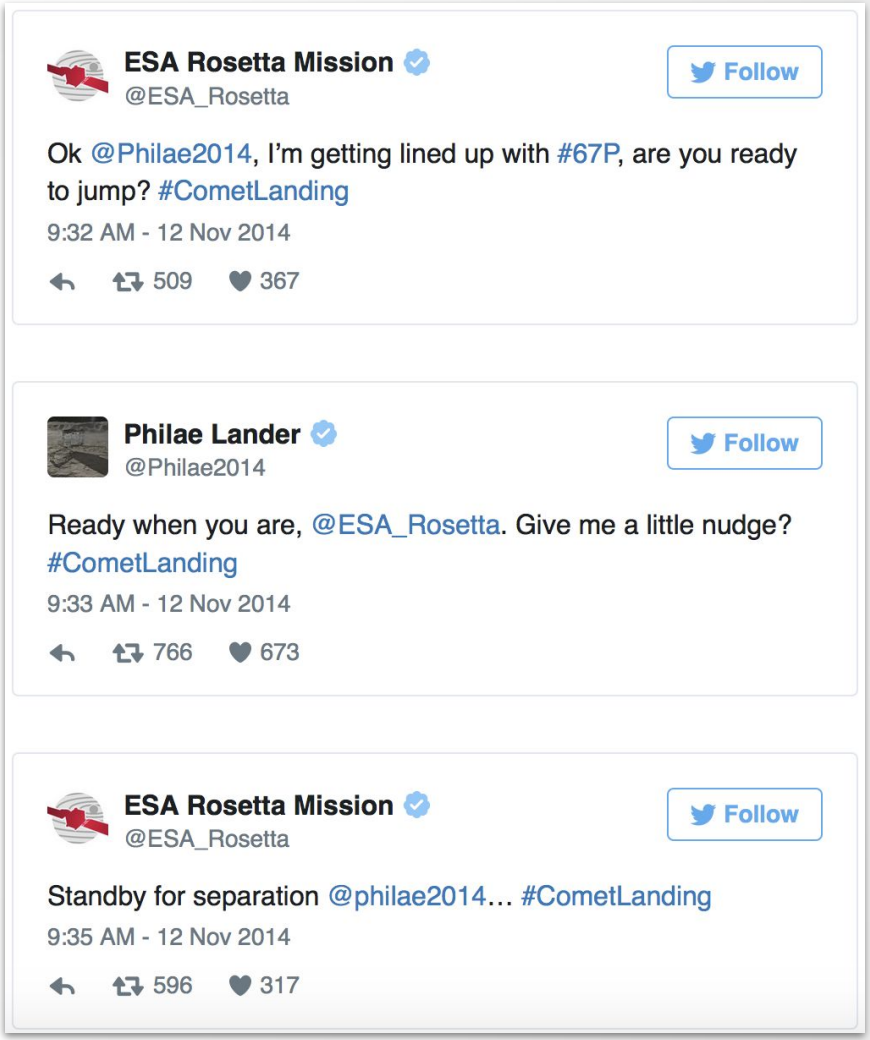
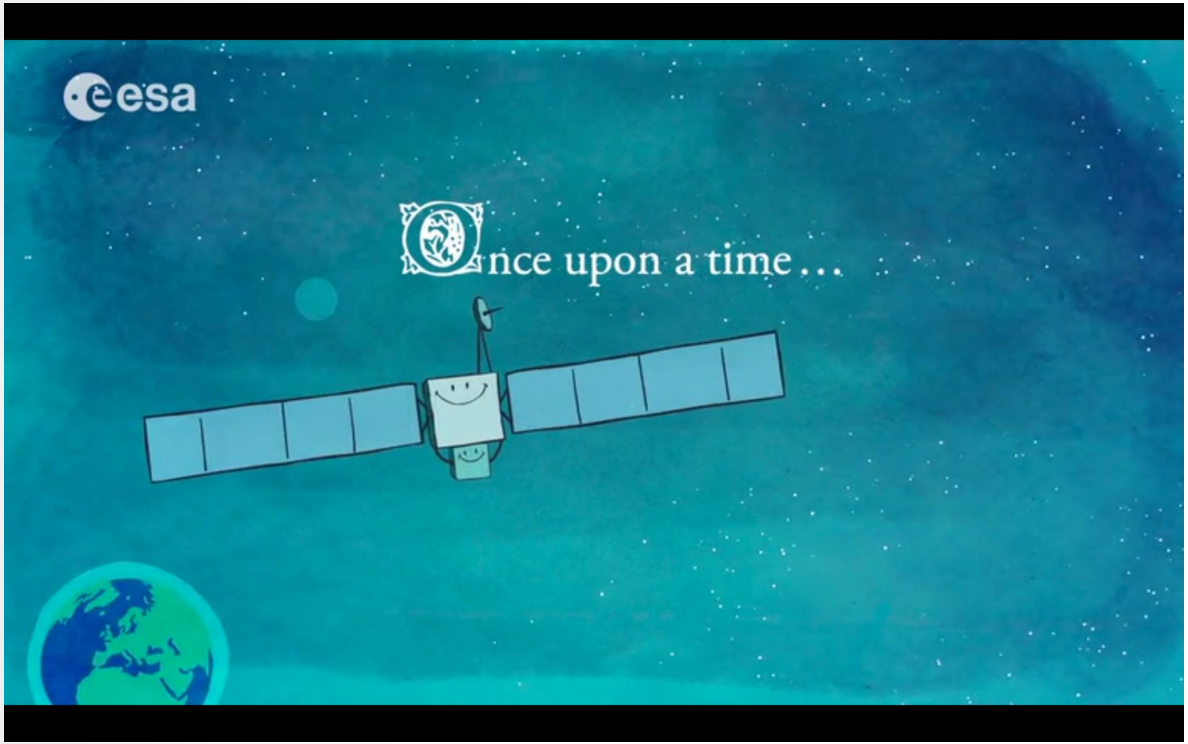
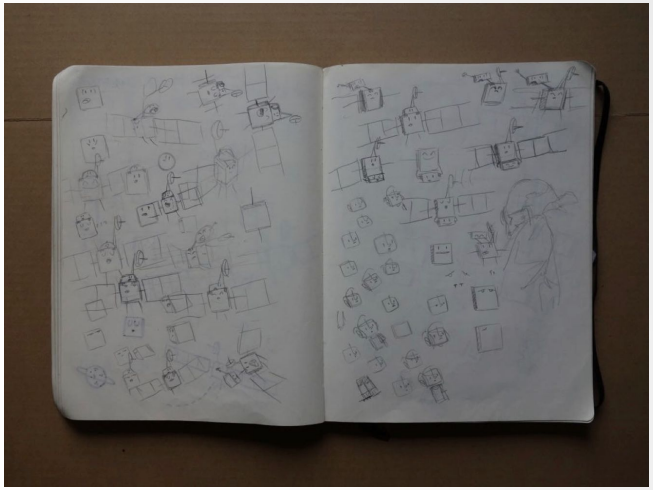


Cartoon series

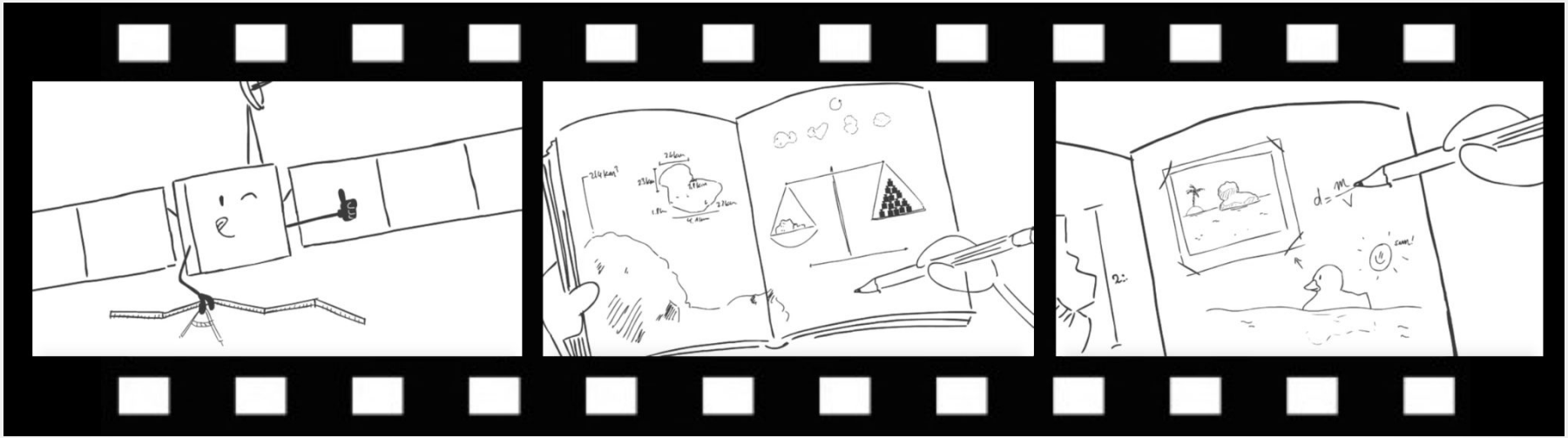




A collaboration between ESA and Design&Data

Mignone et al. (2016), Communicating Astronomy with the Public Journal

Cartoon series



- Characters: two anthropomorphic space probes
- Fairy tale flair
- Accurate science analogies / metaphors

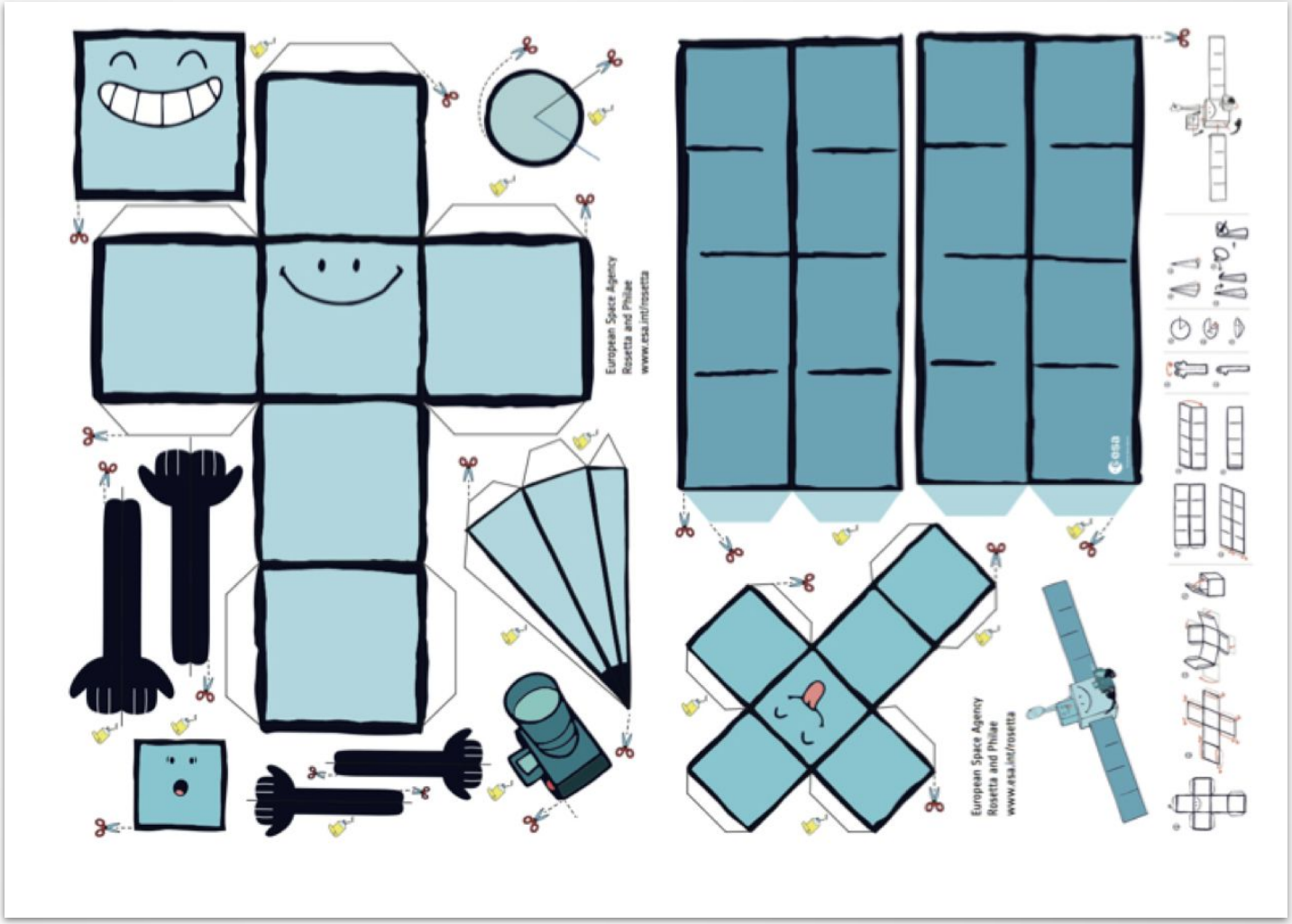
Mignone et al. (2016), Communicating Astronomy with the Public Journal

10 web episodes
(2013-2016)

5 languages

Final production
25-min short film, also adapted for planetarium

Paper model


European Space Agency
Rosetta and Philae
www.esa.int/rosetta
European Space Agency
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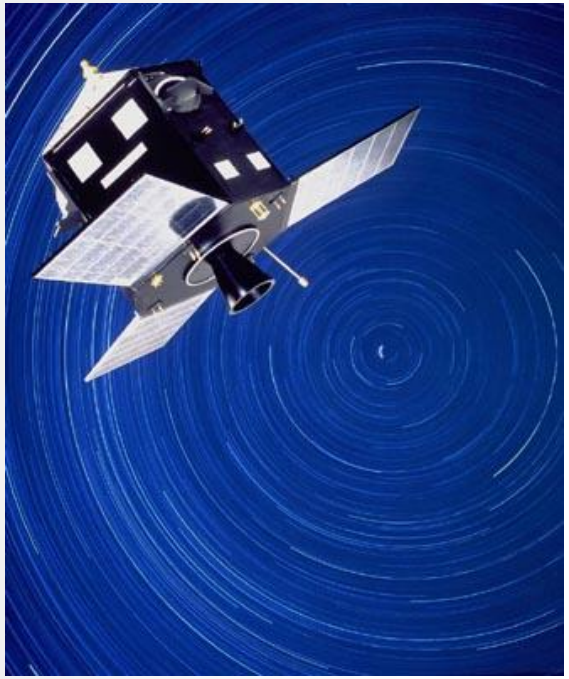
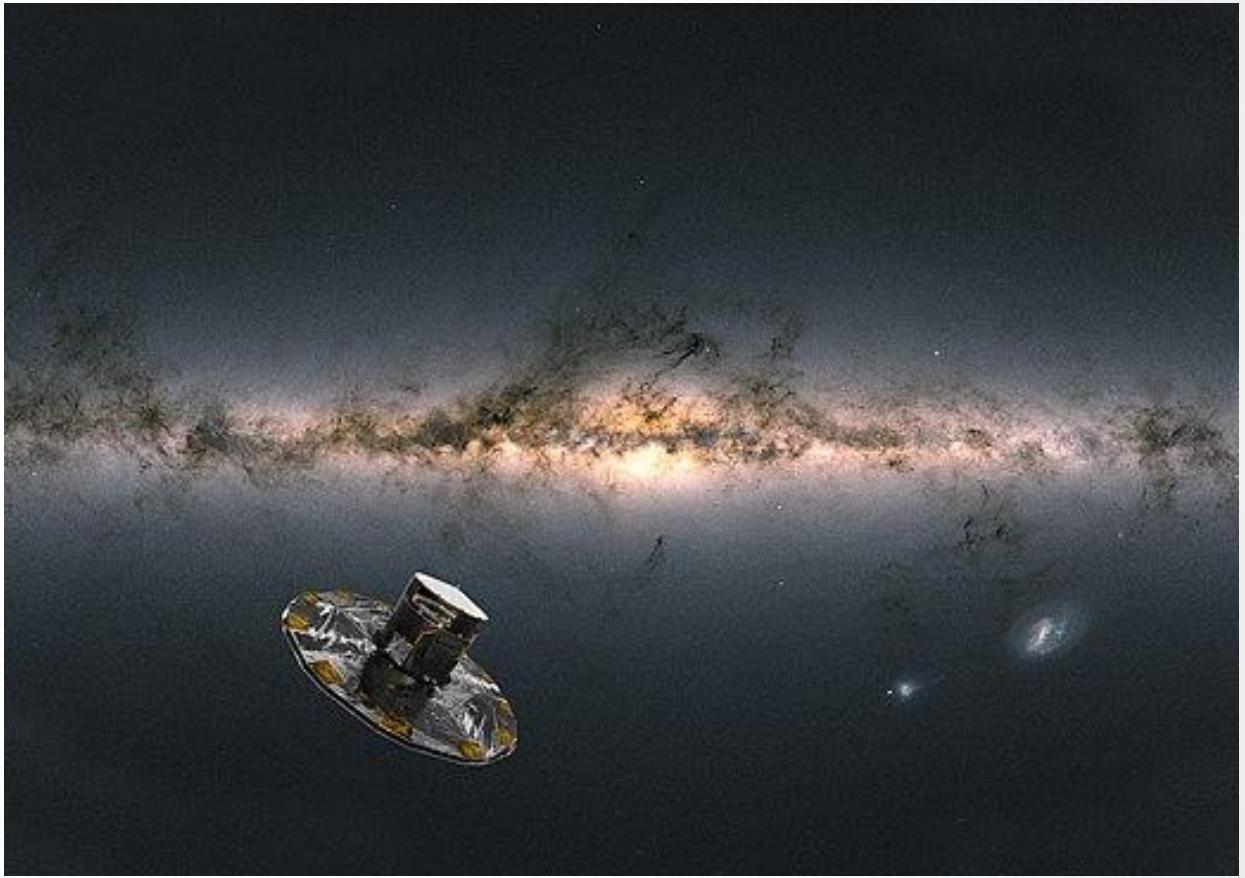
Astrometry: from Hipparcos to Gaia





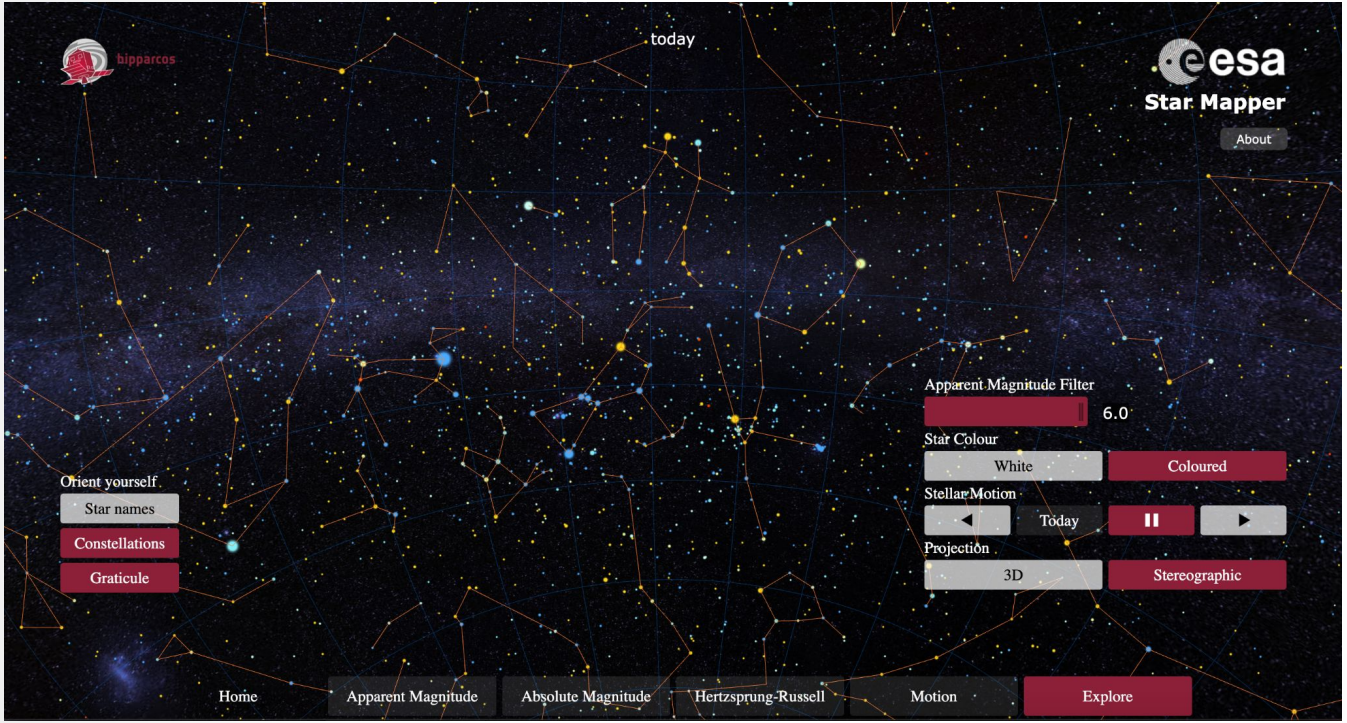
Two interactive data visualizations

ESA’s Star Mapper

Gaia’s stellar family portrait

A collaboration between ESA and Jan Willem Tulp (Tulp Interactive)

ESA's star mapper

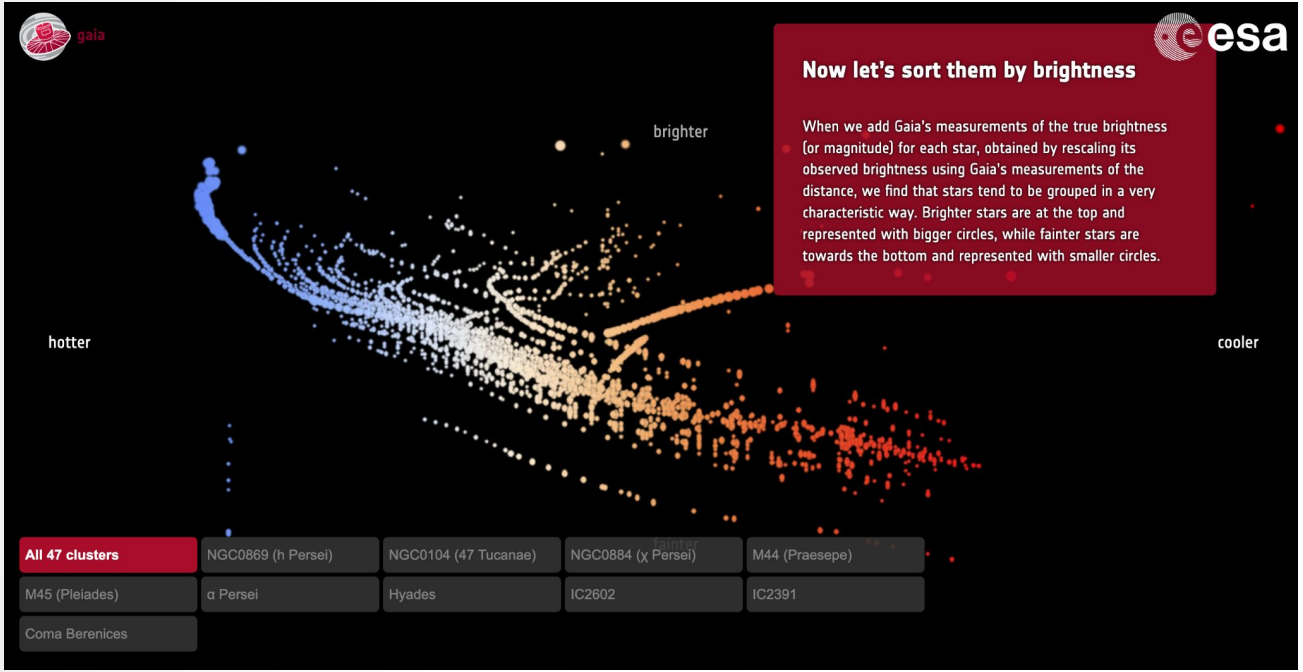


sci.esa.int/star_mapper/

Explore interactively:

- Apparent and absolute magnitude
- Stellar distances
- Star colours
- Proper motions: past and future
- With real Hipparcos data (50k stars)

Gaia’s stellar family portrait



Explore interactively:

- Distance
- Luminosity
- Temperature
- Build step-wise the H-R diagram
- With real Gaia DR2 data from 47 clusters

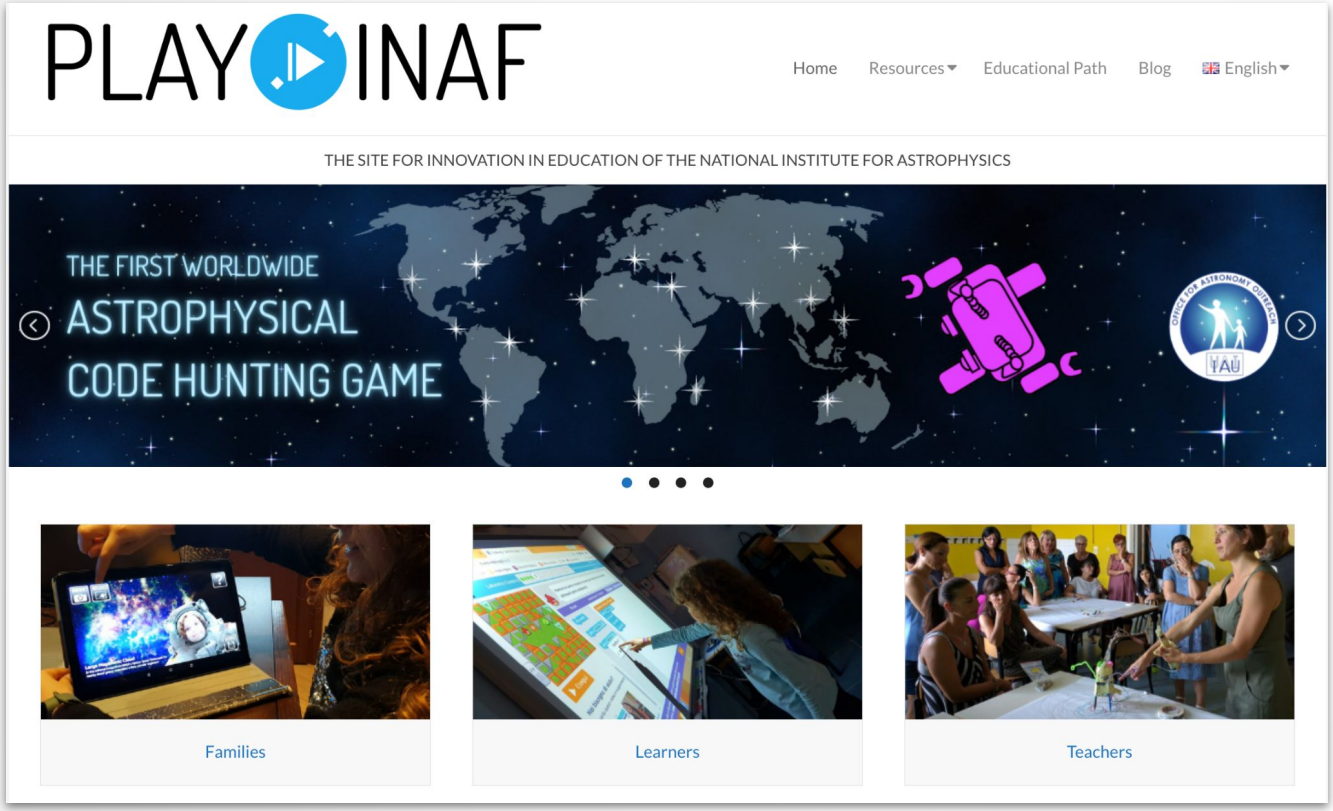
sci.esa.int/gaia-stellar-family-portrait/

Application to education

- Astronomy is the realm of big numbers.
- Bringing the cosmos into the classroom through an astronomy interactive visualization tool provides an opportunity to engage students not only with astronomical concepts but also with **the broadest range of scales** available to human knowledge, enabling them to develop **a sense of scale** and start thinking in terms of orders of magnitude.
- Both applications can be combined into a **45-50 minute lesson plan**, as a recap of basic concepts at the end of an introductory astronomy course
- Alternatively, **individual concepts** and the corresponding interactive visualizations can be incorporated into different lessons, when the various concepts are introduced.

Leonardi, Mignone et al. (2023), Memorie della Società Astronomica Italiana

Innovative STEM education



8 sections:

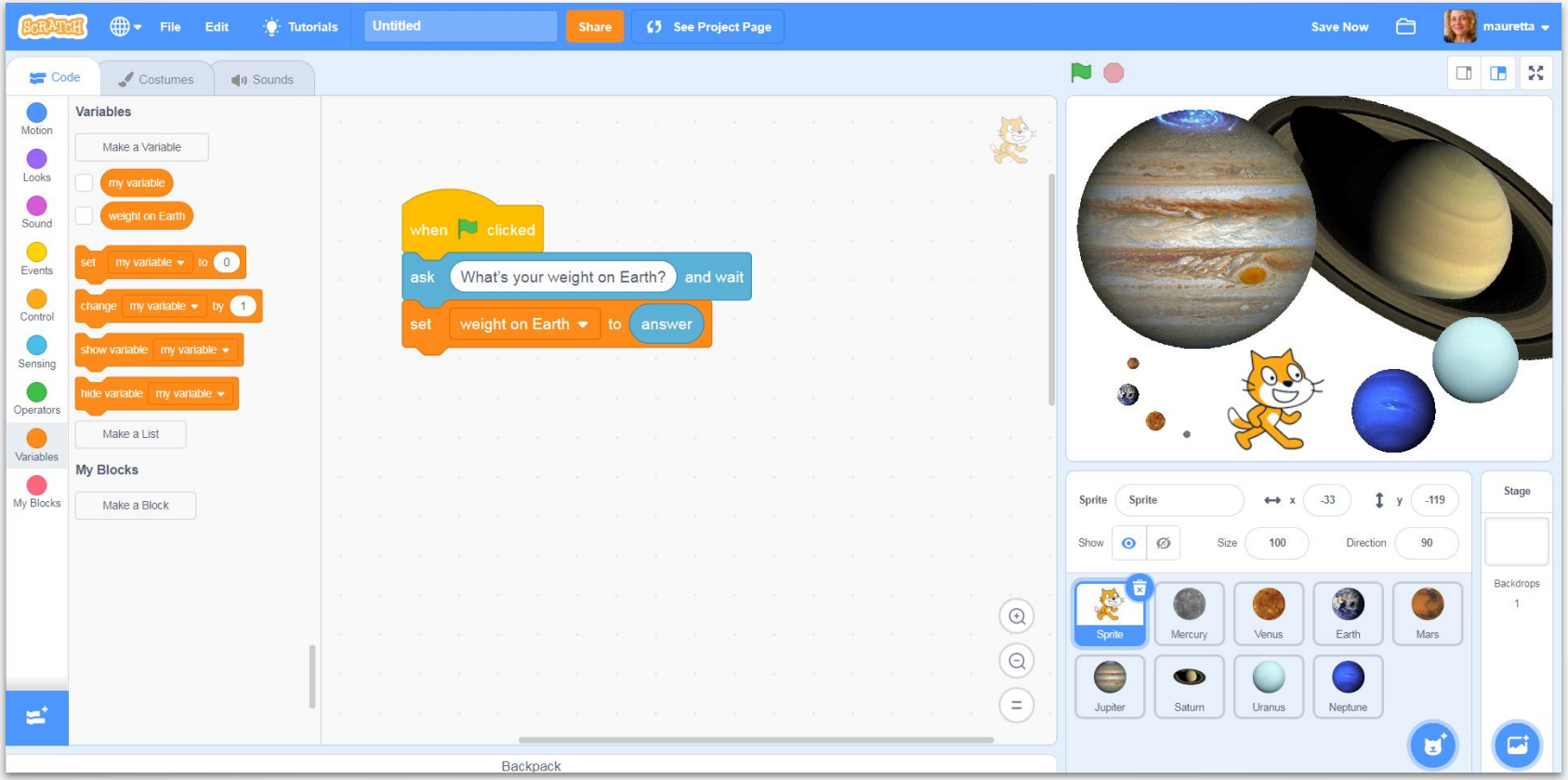
- coding
- robotics
- making
- tinkering
- hands-on
- AR
- VR
- games

4 languages

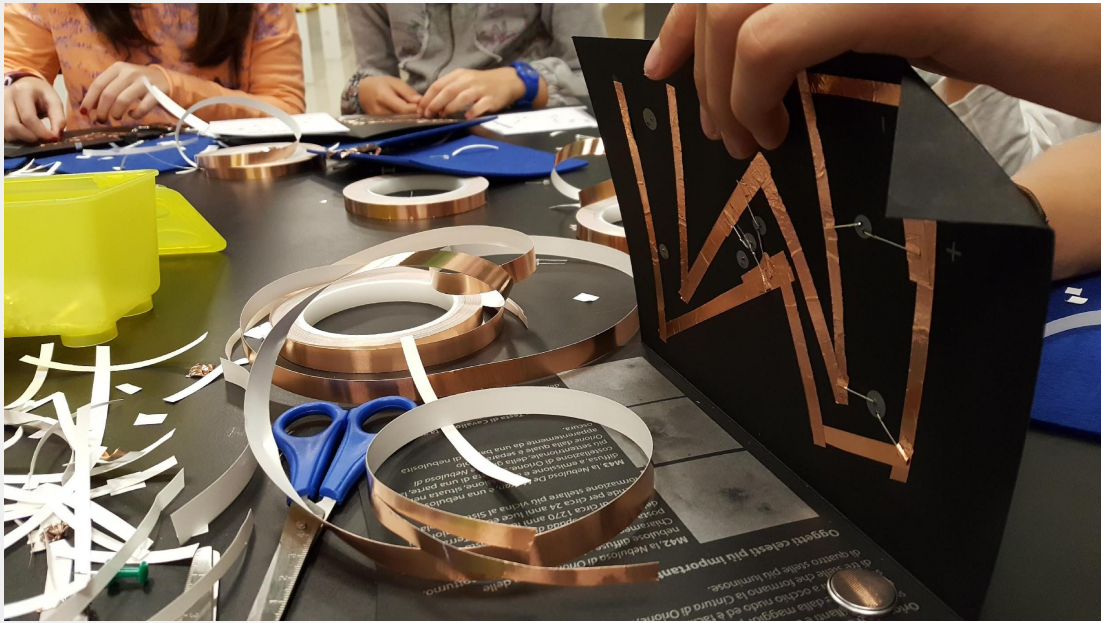
play.inaf.it

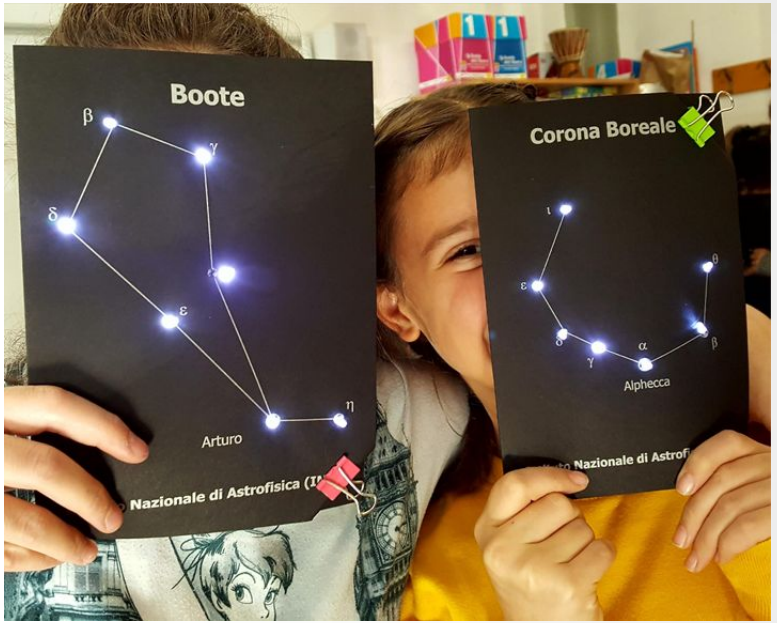
@play.inaf

Example: Astronomy and coding



Example: Astronomy and making





Let’s light up the constellations (by Maura Sandri)

Astronomy and computational thinking

The Astrophysical Cody Maze

- A virtual labyrinth in the real space:
- Combines astronomy quizzes + coding challenges
- Using Telegram on your smartphone

Sandri, Mignone et al. (2023), Memorie della Società Astronomica Italiana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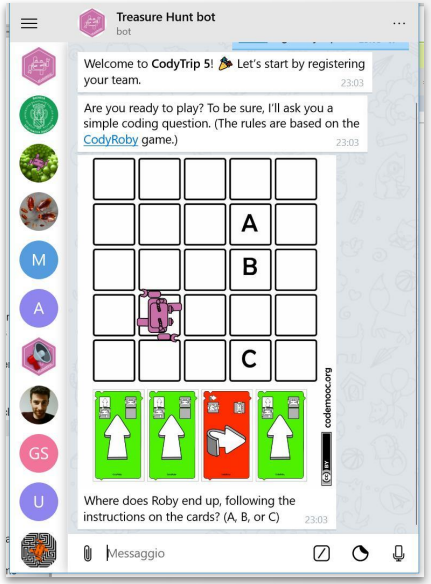
Astronomy and computational thinking

The Astrophysical Cody Maze

Sandri, Mignone et al. (2023), Memorie della Società Astronomica Italiana

Astronomy and computational thinking



- A virtual game with coding quizzes and a worldwide astronomy treasure hunt
- Using Telegram on your smartphone

Sandri, Mignone et al. (2023), Memorie della Società Astronomica Italiana

Astronomy and computational thinking

5 languages

6 continents
300+ places from which we observe, study or tell stories about the Universe

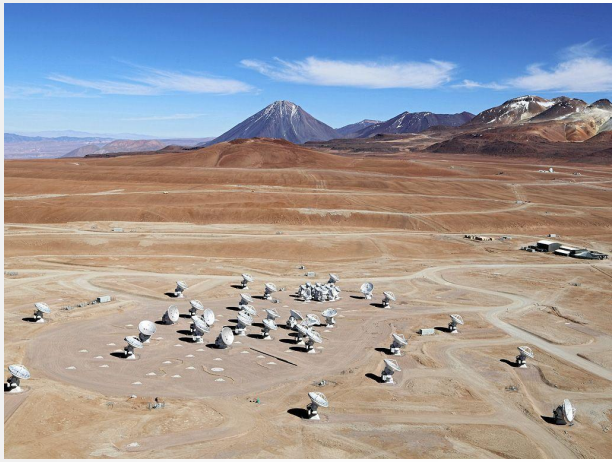
Sandri, Mignone et al. (2023), Memorie della Società Astronomica Italiana

Astronomy and civic education

Play Decide: a debate format to facilitate respectful, fact-based group discussions about the societal impact of large astronomical infrastructures

- Created by INAF Univers@LL WG
- Currently available in Italian and English
- Aimed at secondary school students
- Also effective as awareness exercise within the astronomical community
- Three steps (max 90 min):
  - Information: clarify their own personal view on the subject
  - Discussion: all players discuss together
  - Deliberation: the group formulates a shared response.

Astronomy and civic education



Top left: Alma (Chile); centre & right: Mauna a Wakea (Hawai'i);
Bottom: SKAO (South Africa & Australia)

Astronomy and civic education

- 24 Info cards
- 22 Issue cards
- 16 Story cards

Story Card 1

Nahuel Huilipàn

I'm the religious leader of the native community here, where they want to build the large telescope. But this place has been sacred for our people for hundreds of years. It's a key place for our spirituality. Astronomers say they need to build this observatory to study the universe. But we also have ties with the universe, and this place is designated for our rituals which, by the way, do not harm the environment. We shall fight so that the observatory will not be built here and the native people will be finally heard. We shall fight so that we don't lose our identity.

(Photo by FrankOWeaver - CC license)

Story Card 2

Ahmale Nkosi

I'm an astronomer and I investigate the first galaxies in the history of the universe. I studied the methodologies and processes of "western" science but I, too, come from an indigenous community whose traditions and values I share. Studying the cosmos is not just my work, it's a passion to which I dedicate all of my time: I know that this infrastructure would be extremely useful to conduct many research projects, including some of mine. But building it here would destroy the local community, a community which, like my own, has already suffered so much hardship. I can't agree with this project, not like this. We must find another way, and make an effort to understand what is really useful to both communities.

Story Card 3

Charles Brown

I'm a scientist from the United States and lead an advanced research group: our goal is to find out whether there are rocky planets, with atmospheres similar to our own, that could potentially host life forms. I am convinced this research is of the utmost interest, not just for the scientific community but for the whole of humankind. The only way to make progress with our research is to build instruments like this telescope: it will be able to answer our questions and this is the best place on planet Earth to host this instrument. The only place. We can't stop now. Without this project, for us it's game over. There is no other way to advance our knowledge.

Info Card 1

Large telescopes need to be built in isolated places

Optical and infrared telescopes must be built in places where the atmospheric turbulence, which deteriorates image quality, is minimal: high-altitude locations with low humidity and low light pollution, such as peaks in the middle of the sea or plateau deserts. Radio telescopes, on the other hand, need areas with little radio pollution and microwave interference: deserts free from the emissions caused by telecommunications and other human uses.

Info Card 2

Large telescopes need to be built in very large spaces

The construction of large telescope systems requires very large spaces with specific terrain characteristics (e.g., vast plateaus, or rocky deserts). Such vast areas are unlikely to be entirely free of anthropogenic installations, and sometimes they must be expropriated from those who currently occupy them.

Info Card 3

Technologies developed for large telescopes have industrial spin-offs

Cutting-edge instruments for astrophysics often require pioneering technologies that are developed especially for the occasion. The industries involved in the development of these technologies acquire very specific skills, which specialize them in the relevant sector, placing them in a position of leadership, including for future application spin-offs

Issue Card 1

Consumption of water and other resources

The construction of a large infrastructure for modern astrophysics implies an additional – and sometimes significant – burden on the use of local resources, such as water or electricity, which can become insufficient for the usual use on the territory.

Issue Card 2

Impacts on land and ecosystems

The establishment of large infrastructures modifies the local ecosystem through the occupation of space or changes such as deforestation, levelling of mountain ranges, reduction of natural spaces, etc. This can result in serious changes or could even compromise the survival of some animals or plant species.

Issue Card 3

Land expropriation

The acquisition of lands to build a large infrastructure may require their expropriation or the change of their designated use.
This can have a not negligible impact on the lives of locals. This process must be managed in a very careful and responsible manner and must involve the local communities in order to coordinate as best as possible all decisions on the issue and offer fair compensation.

Astronomy and civic education

Download the game materials

If you use it, leave us your comments!

Astronomy for development: Closer to the sky

Co-creating astronomical knowledge in a favela of Rio de Janeiro
At the Ninho das Águias cultural centre in the **Cantagalo Pavão Pavãozinho** (PPG) complex

Astronomy for development: Closer to the sky

- **Astronomy** after-school classes for 4-12 y/o children
- Training teenage students as **“astro-guides”**
- Creating new **educational material** with a decolonized vision of science & bridging with the local art scene
- Led by Arianna Cortesi (Obs. do Valongo, UFRJ)

Astronomy for development: Closer to the sky

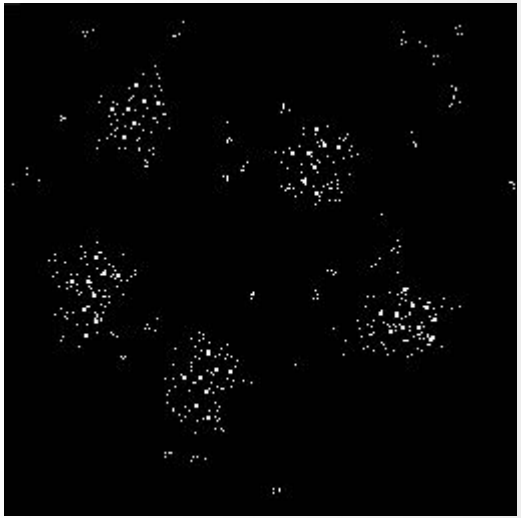
Project goals:

- **Mental well-being** of children and teenagers of the community, through the **restorative power** of **stargazing** and **contemplating the universe** *(Vertue, 2022, Mental Health Matters)*
- Promote **quality education**, STEM and gender equality
- Support **cultural work** and **empower people** of the community

A sign in space: public engagement meets performance art

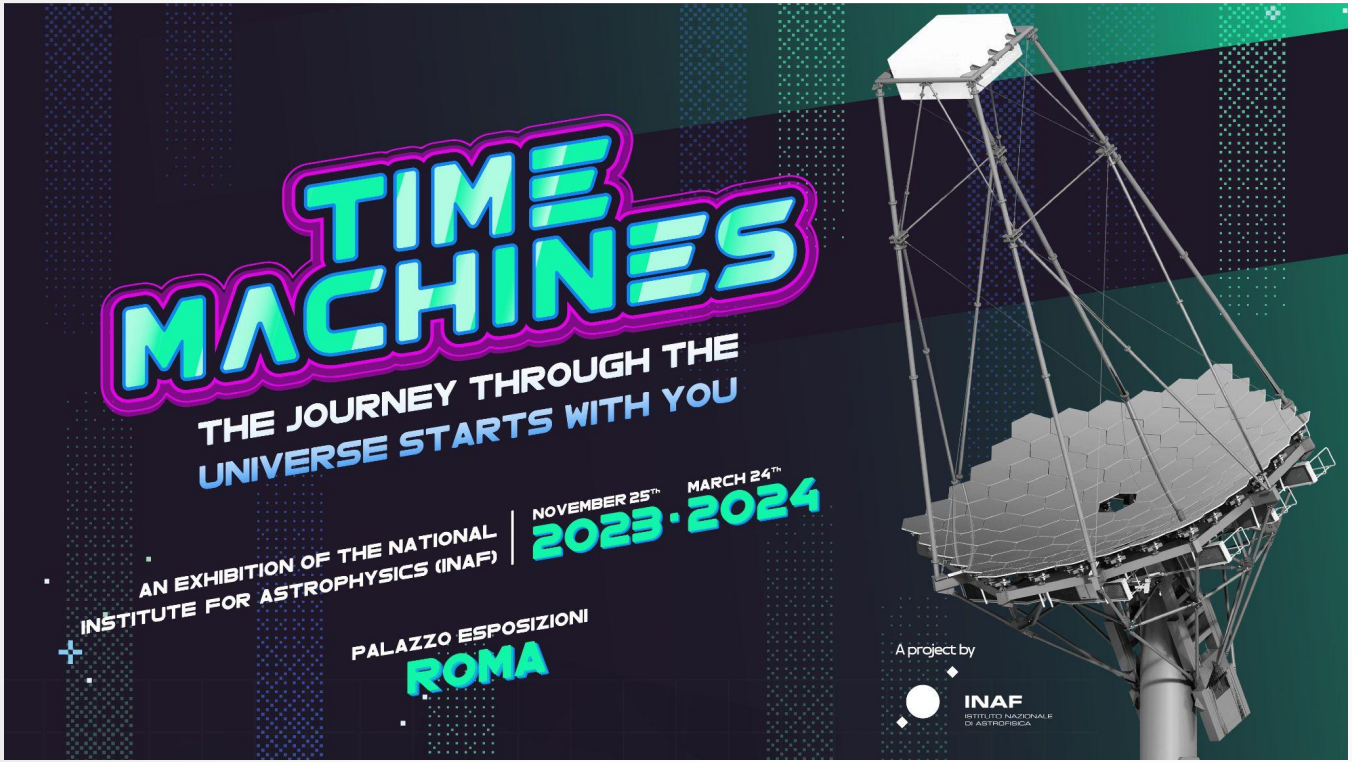
A project by multimedia artist **Daniela de Paulis** in collaboration with ESA, INAF, the SETI institute and the Green Bank Observatory

- A (mock) extraterrestrial message was beamed on 24 May 2023 from a Mars orbiter towards Earth
- 3 world-class radio telescopes receive the message
- Thousands of people around the world joined the challenge to decode the message
- Message decrypted in 7 days
- Interpretation still ongoing on Discord: everyone can participate!

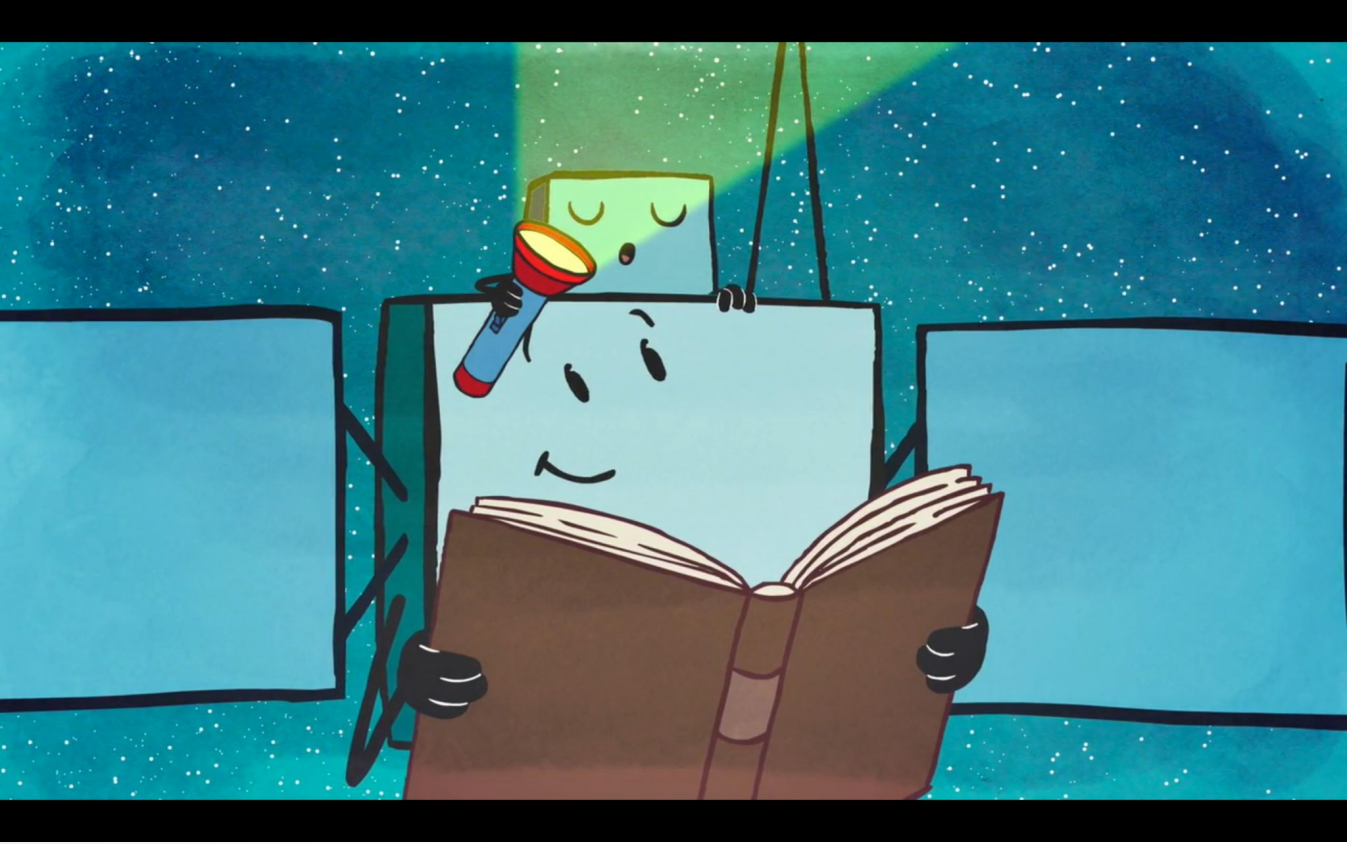


asignin.space

Time machines: an exhibition to discover the beauty of the Universe



If you happen to travel to Italy in the next few months!!!



Obrigada!

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