



The glass ceiling through the lens of science

Gender Inequality in Astronomy, at INAF and Beyond

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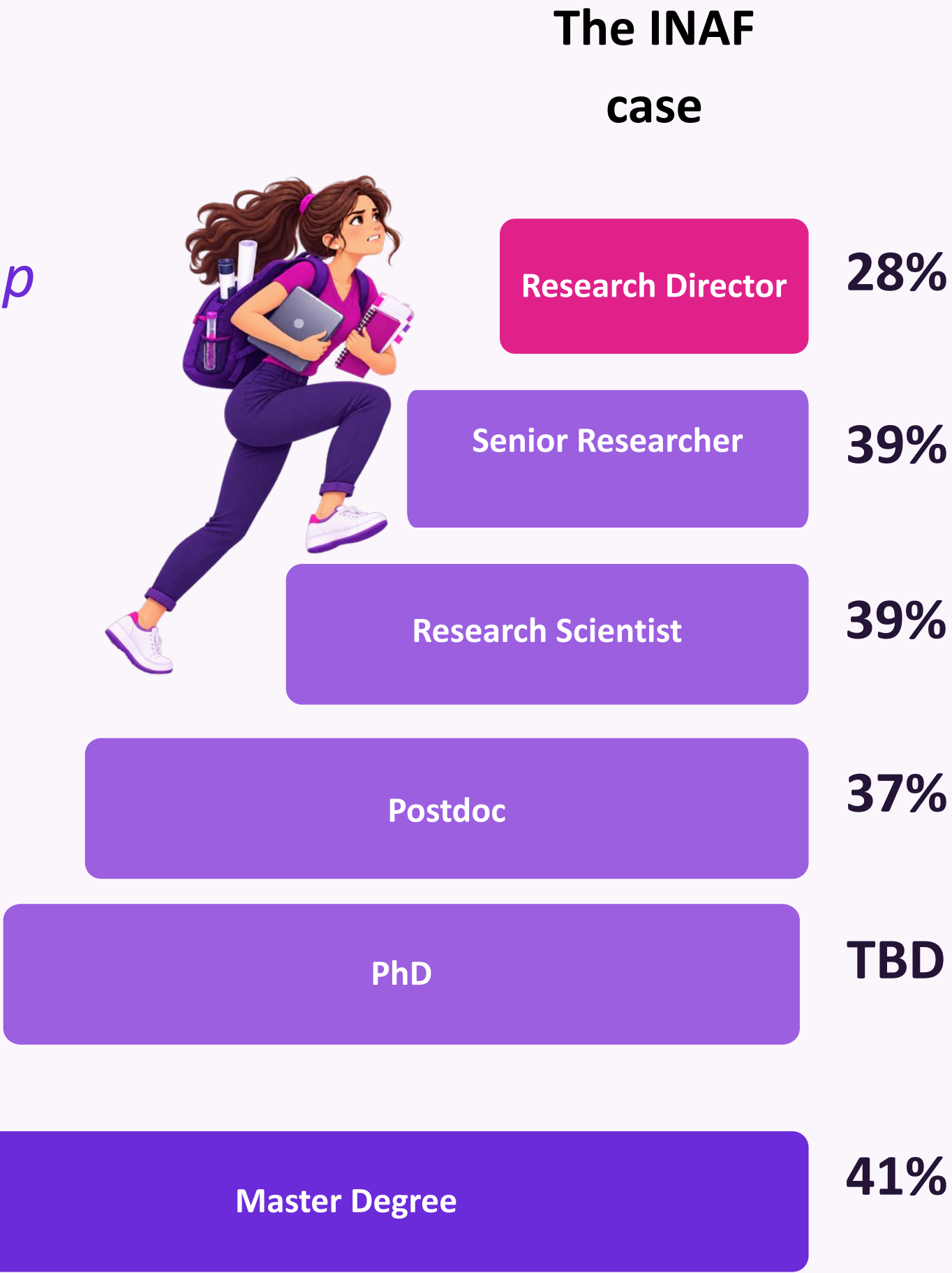
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Same training, equal or better performance, DIFFERENT CEILING

not fewer women entering the field, but fewer reaching its top

Women in astronomy remain underrepresented at senior career levels, despite comparable or better academic performance than their male colleagues

And it isn't only about promotions: the same pattern shows up in panels, invited talks, and telescope proposals...



Not just promotions: who gets invited to speak

Italian Physics Society congresses: Astrophysics section



The 2018 outlier

Gravitational-wave year: several women spoke as spokespersons of major collaborations. Visibility moved the number for one year

And when women are there...

...they more often chair the session than give the talk. Gap between women's and men's chair-to-invited ratio:

2010	+112%
2013	+142%
2016	+44%
2019	+30%

Still positive: women chair more than they speak

Where organisers commit to balance (ESO workshops, EAS, AAS meetings...) speaker ratios realign with the community

What quotas don't fix
Men are still ~2.5× more likely than women to ask a question
Carter et al. 2018: 247 seminars, 10 countries

Zooming out: the same bias at the telescope

Proposal success rate, female vs male PI

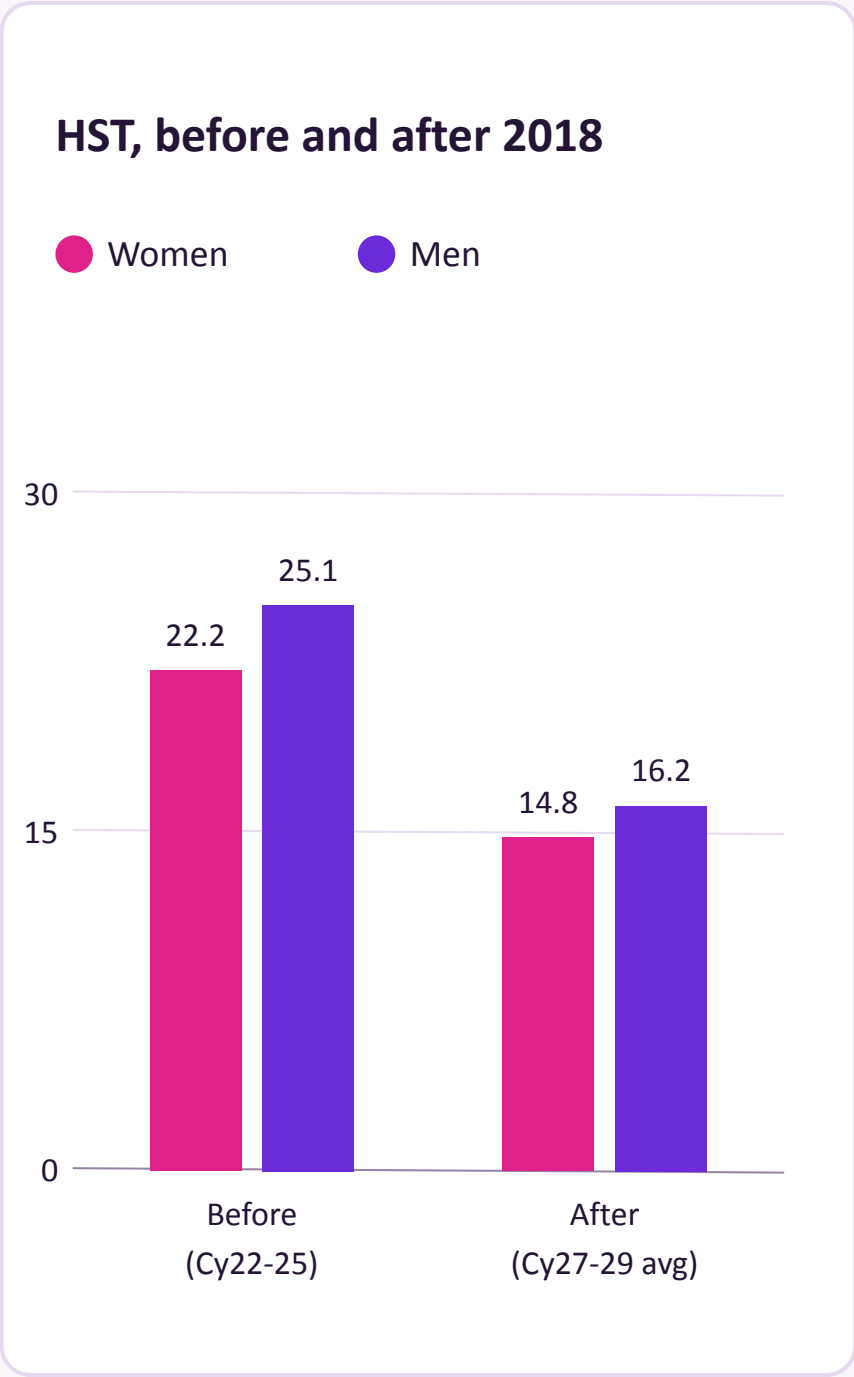
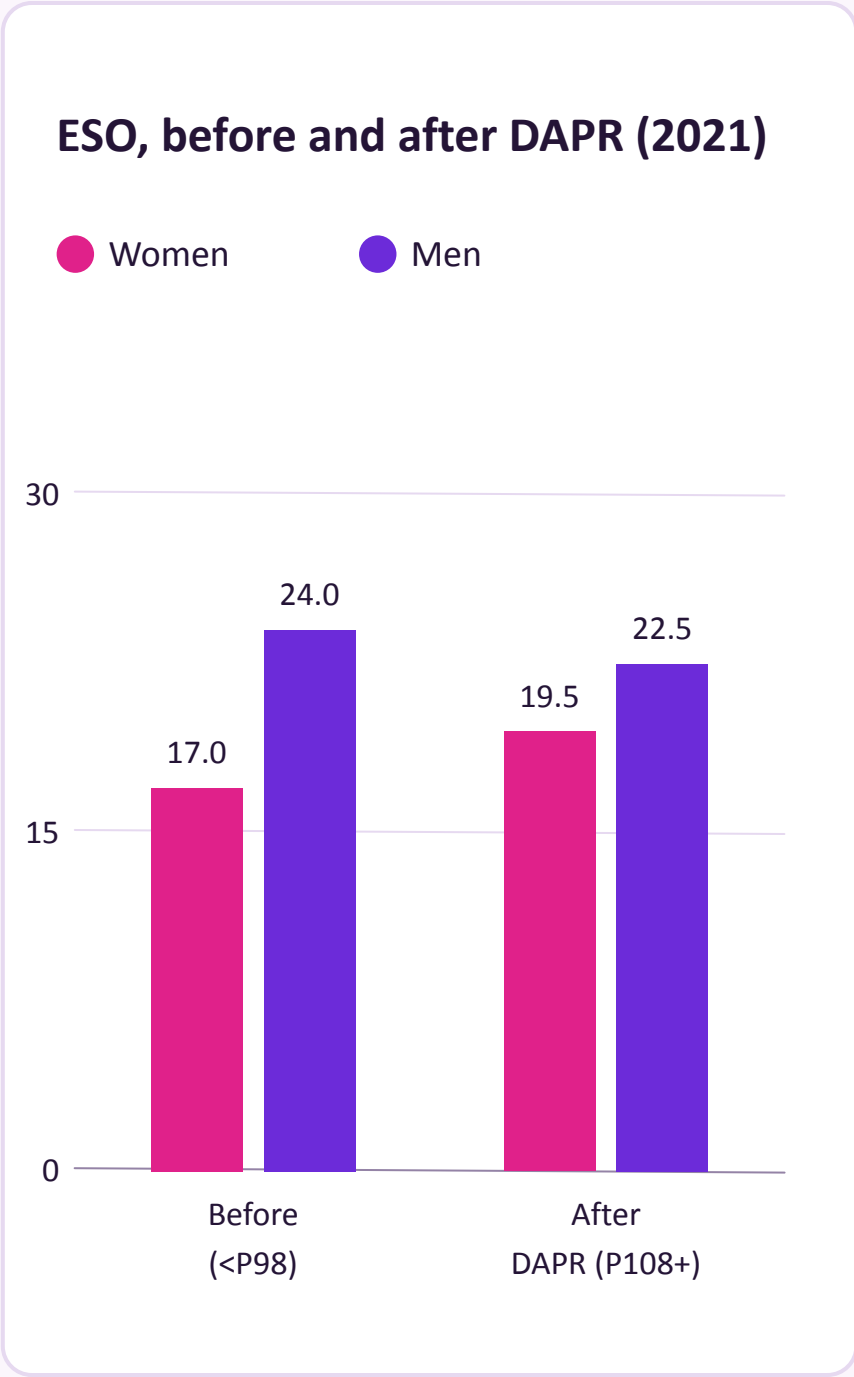


Also documented at **ALMA/NRAO** and **XMM-Newton**, where male PIs are 5–15% more successful

These aren't isolated findings — they recur across every major facility that has looked for them

Sources: Patat 2016 (ESO); Reid 2014 (HST); Lonsdale et al. (ALMA/NRAO); XMM-Newton proposal study (2024)

Dual-anonymous review: better, not solved



Both facilities show the same shape: dual-anonymous review narrows the gap, but neither closes it completely

“Dual anonymous peer review does help reducing the existing gap, but it does not eliminate it.”

— Primas, Jerabkova, Patat & Boffin, ESO 2024 (Proc. SPIE 13098)

“Dual anonymization helps... but it does not eliminate the differences related to gender-dependent writing styles.”

— Virginia Valian, ESO “Peer Review Under Review” workshop, 2023

Even fully blind, the gap can survive

A study of nearly 6,800 Gates Foundation research proposals found reviewers, blind to identity, still scored women's proposals lower. The gap could not be explained by reviewer traits, topic, or applicant track record

*The gap survived every control except one:
how proposals were written.
Men and women use measurably different
words, and reviewers rewarded the men's*

*Women tended to write in narrower, more
specific terms.
Men used broader language and reviewers
rewarded it*

BUT

*What won higher scores did not lead to
better science*

Not just an anecdote

The same conclusion was reached independently at ESO's own 2023 “Peer Review Under Review” workshop, discussing dual-anonymous telescope-time review

*Two independent settings, grant review and
telescope time, pointing to the same
underlying mechanism*

The bias-denial paradox

Committees that believe gender bias no longer exists have been shown to promote fewer women, not more

Believing the problem is solved is part of how it persists

Source: Régner, Thinus-Blanc, Netter, Schmader & Huguet (2019), Nature Human Behaviour
Independently confirmed by Virginia Valian at ESO's "Peer Review Under Review" workshop (2023)

Why? It starts in childhood

“Draw a scientist”

At age 5-8, a majority of children draw a female scientist about as often as a male one. By age 16, only about 1 in 4 do

Unequal attention in the classroom

Teachers give differential, often unconscious, attention to boys and girls in STEM subjects, reinforcing who is expected to “belong” in science

Both mechanisms converge on the same result: girls learn to doubt their own ability, even when their grades say otherwise.

It's the same pattern later known as impostor syndrome

Sources: Chambers 1983; Miller et al. 2018, Child Development 89(6), 1943–1955; Leaper & Brown 2014, "Sexism in Schools," in Advances in Child Development and Behavior Vol. 47; Beilock, Gunderson, Ramirez & Levine 2010, PNAS 107(5), 1860–1863; Sadker & Sadker 1994, Failing at Fairness; Subirats & Brullet (fine anni '80); Clance & Imes 1978.

When the field itself makes it worse

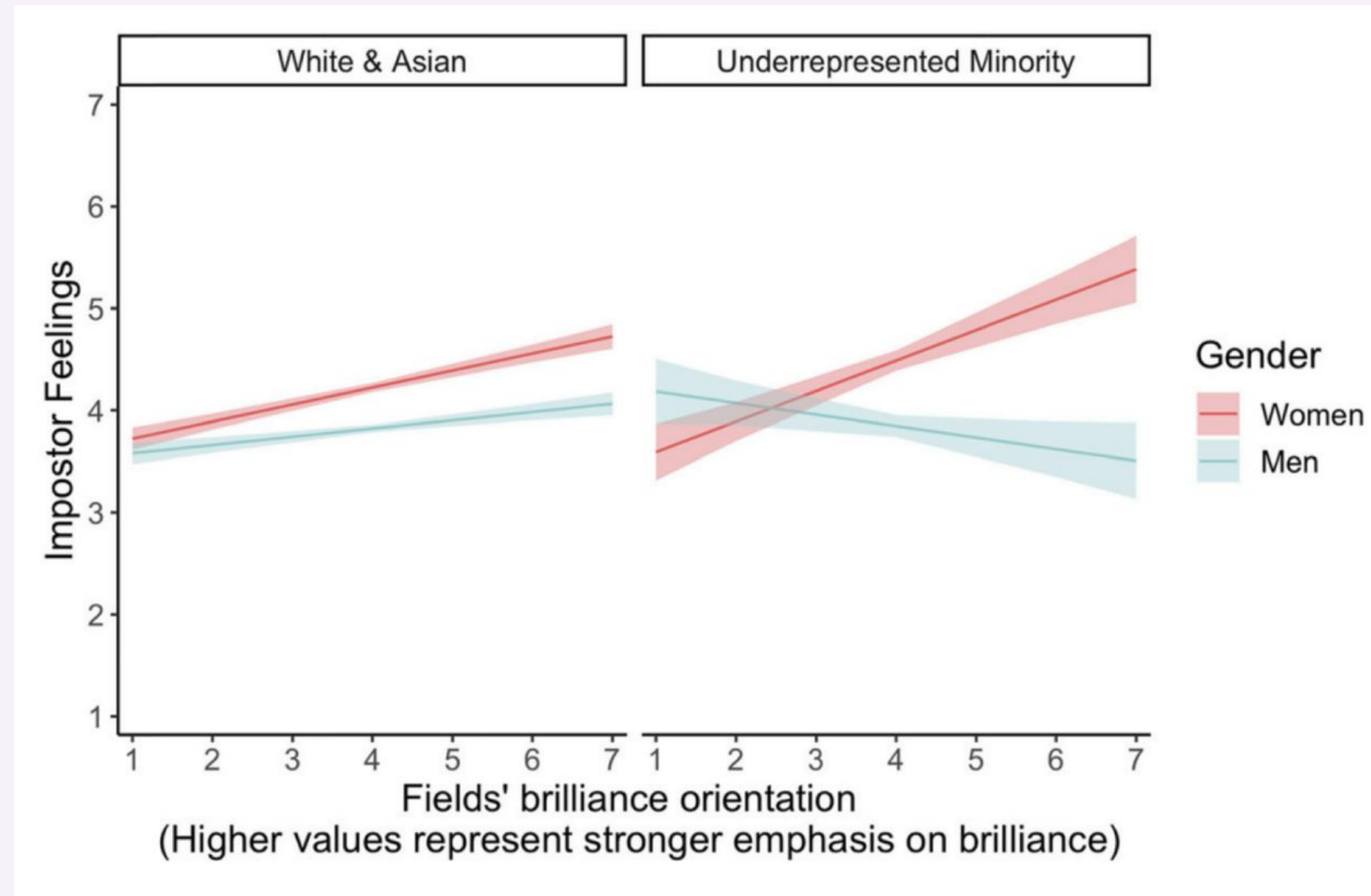
What imposter syndrome is



Feeling like a fraud despite clear evidence of competence and success.

First documented by Clance & Imes (1978) in high-achieving women

Where it hits hardest



*It's not rare, and it isn't only about women.
But it doesn't hit every field the same way*

Be aware of different journeys!



“Members of under-represented groups are strongly encouraged to apply.”

A double bind: underselling, or paying for it

Self-promotion gap

Same skills. Women speak up less, not because they're afraid, but because they doubt themselves.

A later field study confirms the same pattern outside the lab: at equal results, women describe their work more modestly and self-promote less.

Coffman (2014), QJE; Exley & Kessler (2022), QJE

The “competence penalty”

Across 826 people in 140 work groups, with objective ability scores and peer ratings: when a woman's high cognitive ability is visible, colleagues rate her as more hostile and less warm read as a violation of “gender” norms.

*More victimisation, less help received.
Men with equal ability face no such cost.*

Chawla et al. (2026), Journal of Applied Psychology

Underplay your work and stay invisible. Show what you're worth and pay a social price your male colleagues don't.

Structural factors: children and careers

The child penalty

Before a first child, careers track almost identically. After, they diverge, a lasting 20% earnings gap that never closes

Now it's the main driver of the entire gender pay gap

Same pattern at INAF

Women are 39% of researchers at entry level, and still 39% at the second level. At the top, Research Directors, they are 28% - only 21 women out of 76 in the whole institute.

And women still take 78% of parental leave at INAF

Relazione CUG INAF 2025

Kleven, Landais & Sjøgaard (2019, 2021) - Spoon et al. Science Advances 2023

Beyond caregiving

Women don't leave mainly because of caregiving — they leave mainly because of a hostile or unwelcoming workplace.

Spoon, LaBerge, Wapman, Zhang, Morgan, Galesic, Fosdick,
Larremore & Clauset (2023), Science Advances 9(42), eadi2205

Same start. Different ceiling

INAF's own response: the INAF Gender Equality Plan

24 Actions (2025–2027)



1

**Work-life balance &
organisational culture**



2

**Gender balance in
leadership & decisions
making**



3

**Gender equality in
recruitment
& career progression**



4

**Integrating the
gender dimension
into research and
teaching content**



5

**Measures against
gender-based violence,
including sexual
harassment.**

What INAF is doing, and where to go next

Already in INAF

- 5-area Gender Equality Plan, funded and monitored
- Fund for child-care costs during meetings (AT1-3)
- Scholarships for early-career women (AT4-4)
- Mandatory gender-equity training for leadership, panels & working groups (AT2-3)
- Gender balance as a stated goal for INAF conferences, SOC, LOC, speakers (AT4-2)
- Listening desk (Sportello di Ascolto), psychological support for all staff (AT5-2)
- Consigliera di Fiducia, dedicated role for harassment & discrimination cases (AT5-5)
- iniziative per 11 febbraio nelle scuole di ogni grado
- UniversALL initiatives

Room to do more

- Make AT4-2 measurable: proportional gender-balance targets for SOC/LOC and invited speakers - the ESO model
- Structured, template-based proposal formats to reduce writing-style bias
- Narrative CVs in evaluation processes
- Gender-leadership training see talk on Sept. 10 at 15
- Structured mentoring programs (Rubin Observatory, Spanish Astronomical Society models)
- Tracking gender balance in prize committees over time
- gender bias training for junior and senior researcher

ONE STEP AT A TIME

123 years

to close the global gender gap at today's pace --> 2148

135 years for salaries and careers



Rules change who sits at the table.

Awareness changes what happens once they're there

We won't get there fast.

But every bit of awareness (in a panel, a classroom, a conference) is a step someone else
won't have to take alone.

Source: World Economic Forum, Global Gender Gap Report 2025.

Sara (Rosaria) Bonito – INAF Osservatorio Astronomico di Palermo, Italy

Project “Astronomia a Scuola e Donne nella Scienza”:
junior students at schools

This talk to peers, with international inputs
(see also Vera C. Rubin Observatory Legacy Survey of
Space and Time - LSST; talk tomorrow at 15:00)

Become aware of our unconscious bias



United Nations
Educational, Scientific and
Cultural Organization

Organisation
des Nations Unies
pour l'éducation,
la science et la culture

Organización
de las Naciones Unidas
para la Educación,
la Ciencia y la Cultura

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منظمة الأمم المتحدة
للتربية والعلم والثقافة

联合国教育、
科学及文化组织

**Message from Ms Irina Bokova,
Director-General of UNESCO**

**on the occasion of the first International Day of Women and Girls in
Science**

11 February 2016

The new *2030 Agenda for Sustainable Development* underlines the power of science as a driver for human rights and dignity, poverty eradication and the protection of the planet.

On this first *International Day of Women and Girls in Science*, UNESCO's message is clear – the new Agenda will not meet its promise without investing in women's and girls' empowerment through and in science.

More than ever today, the world needs science and science needs women.

**Message from Mr Khaled El-Enany,
Director-General of UNESCO,
on the occasion of International Day of Women and Girls in Science
11 February 2026**

Science is one of humanity's most universal languages. It helps us understand the world, heal, innovate and live together. However, this language is not yet comprehensively shared.

To this day, too many women and girls still face barriers that hinder their access to scientific careers. These inequalities are not due to a lack of talent, but to a lack of equity. However, science that excludes half of humanity is impoverished.

At UNESCO, we firmly believe that gender equality in science is achieved through education, the visibility of role models, and environments where everyone can learn, research and innovate freely.

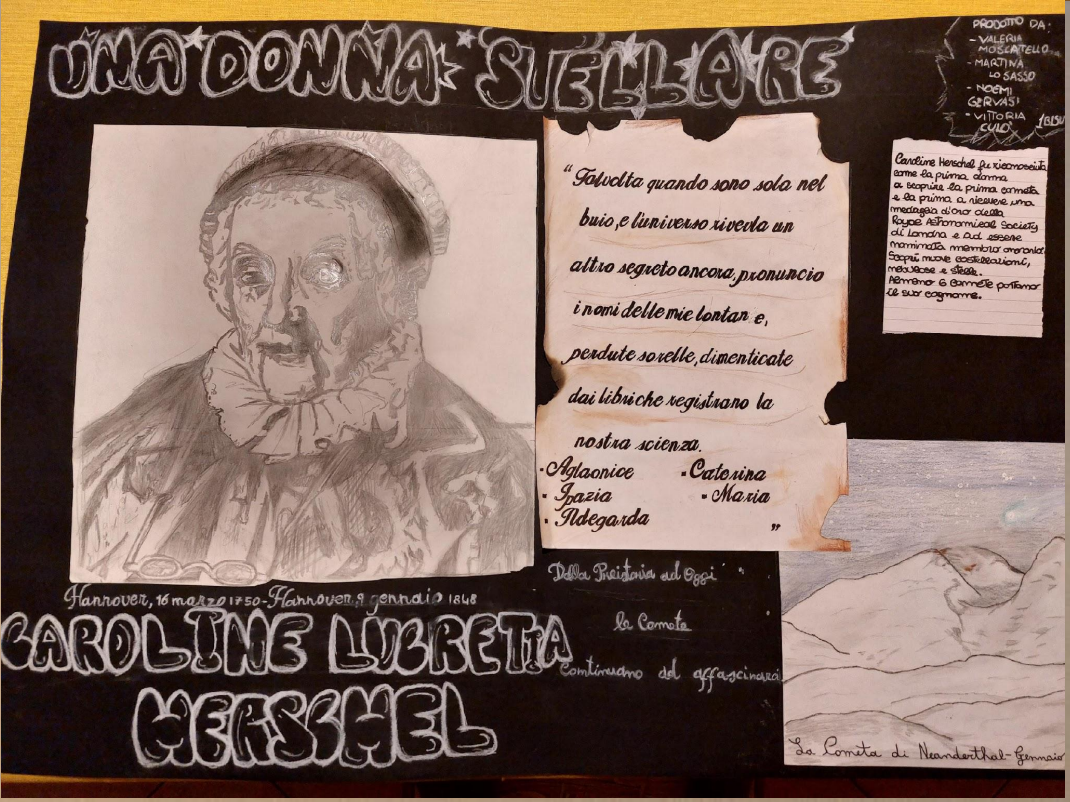
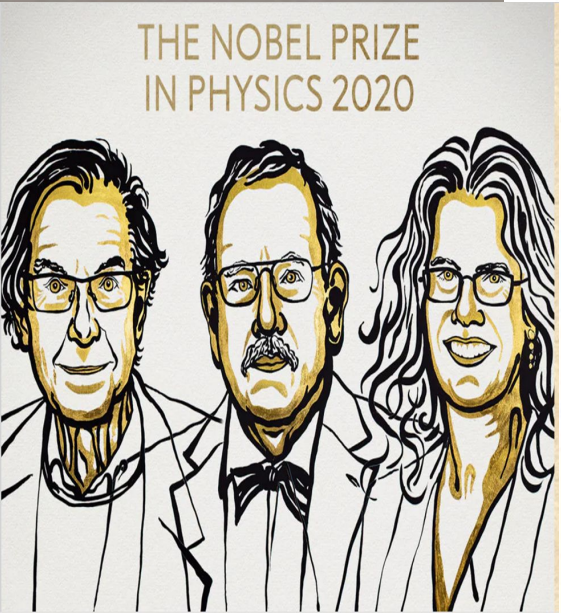
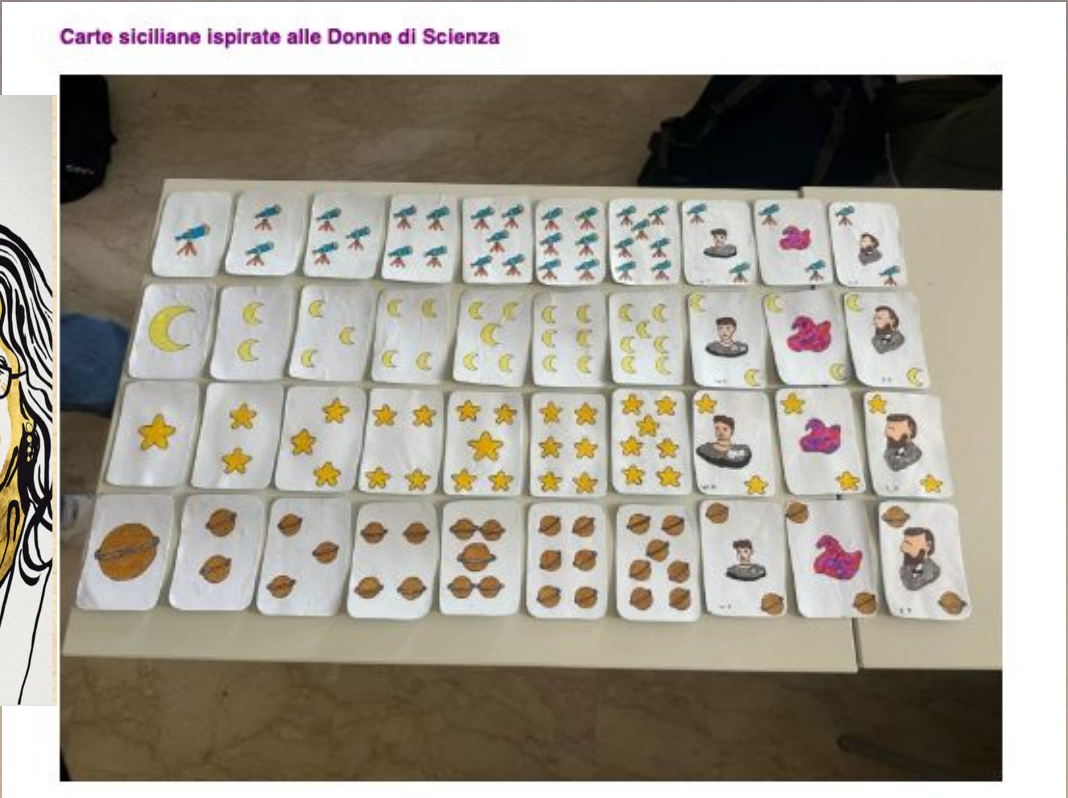
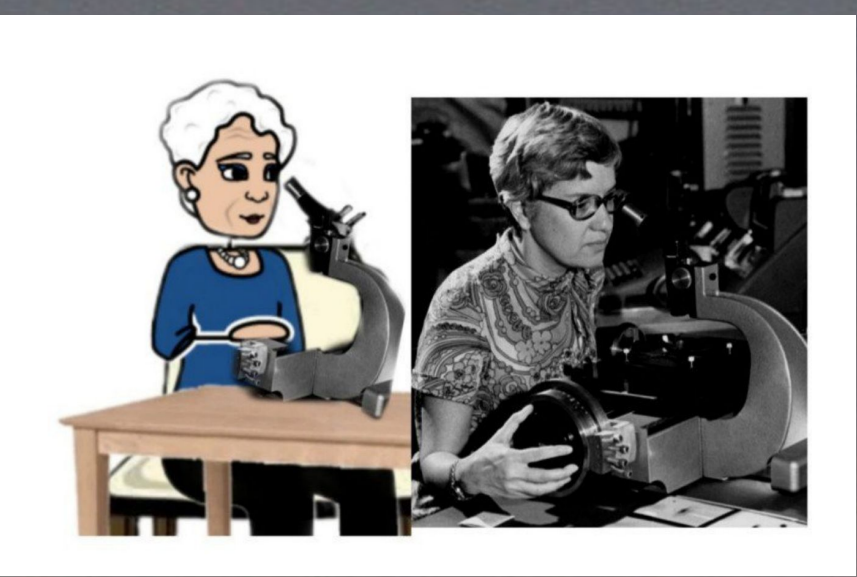
It is in this spirit that our Organization supports initiatives promoting women scientists around the world.

The L'Oréal-UNESCO "For Women in Science" Programme highlights female scientific excellence and supports research careers. The UNESCO-Equatorial Guinea Fellowship Programme for Young Women Scientists in Africa offers concrete research and leadership opportunities.

To further our efforts, this year we are launching the Gender-inclusive Science Institutions and Systems (GenSIS) project, which aims to strengthen the position of women in research and higher education and encourage more inclusive practices.

This is part of the UNESCO Call to Action to Close the Gender Gap in Science and the International Decade of Sciences for Sustainable Development. It is based on a simple belief: science that is inclusive is more useful to humanity.

On this International Day of Women and Girls in Science, UNESCO reaffirms that scientific progress can only meet the challenges of our time if it is shared, inclusive and driven by all.

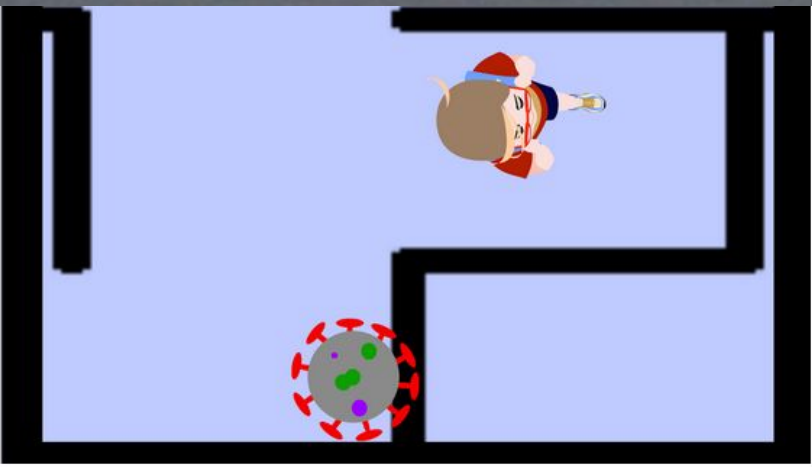


Sara (Rosaria) Bonito – INAF, Osservatorio Astronomico di Palermo (OAPa)



Videogioco dedicato a Marie Curie (CoSpaces Edu)

<https://edu.cospaces.io/BYD-QRJ>



Videogioco dedicato a Katalin Karikò (Scratch)

<https://scratch.mit.edu/projects/1126208613/>



Canzone “Vera Rubin: lei ci mise il suo grande amore”



Women in Science

<https://sites.google.com/inaf.it/donnescienza-inaf/home-page/progetti-passati/progetti-vincitori-2025?authuser=0>



Modellino sulla struttura del DNA e cartellone su Rosalind Franklin



Canzone “Margherita Hack, regina del cosmo”



Trailer del film “Vera Rubin” e modellino dello strumento



Presentazione su Barbara Mc Clintock



Cortometraggio su Vera Rubin



Wanda Diaz Merced e la scienza inclusiva



Presentazione su Margherita Hack



L'enigma di Vera Rubin, escape room



EXTRA. Quadro dedicato a Margherita Hack (1922-2013, astrofisica)



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Ilaria Capua di Madonia 2BLS





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