

## Neither Sheldon, nor Koothrappali, nor Wolowitz: How to change stereotypes in Astronomy with videoconferencing

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**Abstract.** “Habla con Ellas: Mujeres en Astronomía” is an outreach initiative of a group of professionals from the Instituto de Astrofísica de Canarias (IAC), supported and coordinated by its Outreach and Press Unit, which aims to offer children, especially girls, professional role models in science and technology, and to foster their interest in these areas. It consists of videoconferences with schools in which women astronomers and engineers from the IAC and collaborating institutions talk about their work or their research field, and answer questions from the students. The project has been developed over three school years, 2018-2021, in which a total of 130 videoconferences have been held, mainly in Spain, reaching more than 5,200 students from kindergarten to university. The surveys answered by the participating students and teachers show very positive evaluations of the activities and a high degree of achievement of the objectives pursued.

### 1. Introduction

Physics and Engineering are areas in which the under-representation of women is long-standing and persistent and that continue to be perceived by society as “male professions”. If we ask young people to describe a physicist, an astronomer or an engineer, most will think of the characters from the popular TV series “The Big Bang Theory”, who are portrayed as weird, extremely intelligent men with few social skills. Such representations contribute to making these professions seem unattractive to a large proportion of pre-university students of both genders, and may have a more discouraging effect on women.

### 2. Approach

In 2017, a group of female colleagues from the IAC began meeting with the aim of co-creating initiatives that would contribute to change gender stereotypes in STEM (Science, Technology, Engineering and Mathematics), and to foster interest in these fields among students, especially in girls. First, we identified the target audience we wanted to reach. Gender stereotypes are defined at the age of 5-7 years [1] and increase significantly with age, especially among girls [2]. Therefore, we decided to focus on schoolchildren, from kindergarten to high school. We chose the videoconference format for two reasons: on the one hand, to offer a close and contemporary view of the women working in Astronomy, and, on the other hand, to reach quickly and sustainably as many schools as possible in our country (Spain), where there are still many regions that do not have a research center nearby.

This is how “Habla con Ellas: Mujeres en Astronomía” (Talk to Them: Women in Astronomy) came about, a project in which female astrophysicists and engineers hold videoconferences with schools in which we talk about our field of work and answer students' questions about STEM careers, the universe and the methods and tools we use to study it.

The working model we chose was as follows:

- Each edition the **project coordinator** makes a call for participation among IAC staff and collaborating institutions operating in the Observatories of the Canary Islands, and compiles a brief CV of each volunteer. She prepares the web content and the application form, as well as indications for the management and implementation of the videoconferences, presentations and other informative materials for the talks, which she shares with the collaborators. She is also in charge of dissemination, communication and evaluation.
- An IAC **design expert** creates the poster and other designs for the website and social media.
- **Teachers** request the videoconferences by filling in a form where they propose dates, times and preferred language, and are responsible for organizing the activity in their schools.
- The **collaborators** select the activities that suit their availability, agree with the teacher the final date, time, topic and software to be used for the videoconference, and carry it out.

The project was launched during the 2018-2019 school year and has been developed during three consecutive editions, involving 13 (2019), 20 (2020) and 27 (2021) collaborators from the IAC and 10 other institutions.

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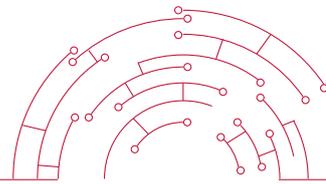


Fig. 1. Poster of the “Habla con Ellas: Mujeres en Astronomía” 2021 edition, with photos of the collaborating speakers. Image credit: IAC.

### 3. Adaptation to COVID-19 lockdown

In March 2020 a lockdown was declared in Spain to combat the COVID-19 pandemic and face-to-face classes were suspended for the rest of the school year. Collaborators confirmed that they could continue with the project from home, so we contacted the schools and offered to do the activities in multi-conference format, reaching the homes of each of the students and teachers. For most schools this was great news and we were able to carry out about 70% of the requested activities. The remaining 30% decided to postpone the activity because a high percentage of their students did not have the means to connect to the videoconference.

### 4. Results and evaluation

Throughout the three editions we have held 130 videoconferences with schools in 15 out of 17 Spanish Autonomous Communities, several in rural areas, and with two student associations in Latin America. We have interacted with more than 5,200 students from all educational levels from kindergarten to university.

The impact and effectiveness of the project in achieving the objectives pursued has been evaluated from the point of view of the participating students and teachers, and also from that of the collaborators. The data presented here correspond to 567 assessment surveys answered anonymously by students over 10 years old and 155 by teachers.

A large majority of students liked the activities a lot or quite a lot (73%) and found them interesting to

the same extent (79%). Sixty-seven percent of the students valued the activity as a positive change in their perception of STEM professions and 69% reported an increase in their interest in these areas.

As for the teachers, 93% of them rated the activities as quite or very positive for their students, and 89% indicated that they had contributed to changing gender stereotypes in STEM among their students.

The evaluation surveys and the meetings of the collaborating speakers and the project coordinator have also served to share our experiences, identify the lessons learned and propose positive changes that we have been implementing for continuous improvement.

### 5. Conclusions

“Habla con Ellas: Mujeres en Astronomía” is an outreach project that has been possible thanks to the contribution of the collaborators, who have dedicated an average of three hours per activity, but also of their institutions for supplying the means to carry out the videoconferences, and especially of the IAC, which has provided the working time of the project coordinator and other staff involved, as well as the means for its management and dissemination.

The results of the evaluation surveys answered by the participating students and teachers show a positive impact of the videoconferences in changing stereotypes about STEM studies and professions and in stimulating interest in these areas among students. The success of the project in meeting the intended objectives, its scope (more than 5,200 students) and the associated low economic cost (dedication of the staff involved) make it an ideal initiative to be replicated by other scientific and technological institutions.

### References

- [1] Bian, L., et al. 2017, “Gender stereotypes about intellectual ability emerge early and influence children’s interests”, *Science*, 355, 6323.
- [2] Miller, D.I., et al. 2018, “The Development of Children's Gender-Science Stereotypes: A Meta-analysis of 5 Decades of U.S. Draw-A-Scientist Studies”, *Child Development*, 89, 6.