

## The GRaffa project: final considerations after one year of activities

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GRaffa is a project designed and carried out by the Associazione Giovanile Le Scie Fisiche, funded by the Lazio Region, with the aim of sharing the excitement of science and increasing appreciation for it, mainly through daily experiences of physical phenomena. It was conceived by young physics and philosophy researchers (mainly postdocs and PhD students) to spread physics and scientific culture by using a simple and fun language dedicated to the general public, especially school students. The main goal of the activities realized within the project is to allow people to understand that physics is not just the study of distant galaxies, particle accelerators or complex mathematical formulas. When we use the computer or decide what is the right oven temperature for baking our cupcakes, we are already doing science! Here we detail the results achieved with the GRaffa project over the last year, as well as a report of a survey carried out with students and teachers involved in the project's activities.

*41st International Conference on High Energy physics - ICHEP2022  
6-13 July, 2022  
Bologna, Italy*

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## 1. Raffa Fa Cose Instagram page: the original idea

The “Raffa Fa Cose” Instagram page was created in 2019, just before the European Researchers’ Night [1] by a group of outreach passionate PhD students in Physics and Geology working at the National Laboratories of Frascati (LNF)[2] of INFN. The goal of the original group was to spread the idea that science in general – and physics in particular – is not just the study of distant galaxies, particle accelerators or complex mathematical formulas, but that has practical implications in our lives. The take-out message to share was, and still is, that it is possible to have fun while learning or doing science. Throughout these years, the group had the opportunity to participate in several outreach initiatives dedicated to the general public, mainly organized by the association Frascati Scienza [3] and the INFN-LNF; moreover, it was assigned a reserved column, called “Dafne fa cose”, in the Instagram page of the LNF: the main topics concerned an explanation of several research activities performed within our laboratories (from collider physics up to gravitational waves), as well as physics application born for research purpose and then spread out in the society. In 2021 the group won a prize from Lazio Region called “Vitamina G: il Bando delle Idee” [4], that helped young Lazio region citizens realize a project with significant impact on the society, and it created a Youth Association called “Le Scie Fisiche” [5]. The project winner of the grant is called “GRaffa - una giovane parentesi sulla Fisica”<sup>1</sup>

## 2. The GRaffa initiative

The GRaffa project was created by three post-docs - respectively working in particle physics, radiation protection, and condensed matter - and one video maker. After the creation of the association, three other PhD students (astrophysics, particle physics and science philosophy), one technician and MSc student in communication engineering joined the group. The association composition is highly diversified in terms of research path and gender, thus allowing to deal with different aspects of the research activities.

### 2.1 One-year goals

The aim of the GRaffa project is to take an active part in the scientific outreach activities on the Lazio Region and to encourage younger generations to get closer to STEM subjects, which are too often regarded as demanding and much detached from communities’ practical benefits. The GRaffa project also aims to strengthen scientific knowledge among adults, for it believes that scientific involvement, independently from the age, could help citizens in taking conscious actions: the decisions we make today affect the future of our cities. Given the high number of female components within the association, a key-point of GRaffa program is to stand as a positive example against stereotypes, such as the fact that scientific subjects are suitable for a minority of the population (more likely to be of male type).

### 2.2 The action plan

To fulfill the prefixed goals of the project through one year of activities, the group organized them on several paths:

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<sup>1</sup>Brace- a curly bracket about physics (it’s a wordplay because our president is called Raffa).

- **social networks** (mainly Instagram and Facebook) with monthly or weekly columns (*e.g.* What's in the sky this months or the physics advent calendar) and posts about every day physics;
- **activities in schools** divided between hands-on laboratories for the primary schools and seminars about modern physics and its application for high schools;
- **You Tube videos** with duration ranging from two to ten minutes on spread topics from particle physics up to why fishes are red;
- **participation in science festivals** mainly organized in the cities of Rome and Frascati.

### 2.2.1 Social media activities

Social media are now a very effective communication tool for engaging with young people, by informing and educating them on issues related to science.

The majority of the published posts was targeted for Instagram with fun, short and effective scientific explanations that are impacting for the audience. A vast use of Instagram stories allowed the group member to interact with their followers, showing the everyday life of a researcher: from the laboratory activities, to the participation in international conferences. Moreover, the group found crucial to interact with the followers to know their curiosities, as well as questions to produce new contents.

In order to keep track of all the performed activities, and give teachers and students the possibility to interact with the association, a website [6] was opened.

At the moment of writing the association is working to start a bi-weekly column on the website about the fundamental discoveries in physics starting from XIX centuries to allow students to deepen their knowledge acquired in school.

For the same reason, in January 2022 the association opened a YouTube channel [7]. The published videos covered scientific and philosophical topics, as well as recap videos for the science festivals the association attend, so that those who were not present could still enjoy the experience.

### 2.2.2 Schools activities

In order to improve the citizens interest about STEM, it is important to start a scientific education at a very early age, paying particular attention to the practical and experimental side. This allows young students to approach and learn the scientific method by stimulating their reasoning skills: through the organized laboratories and activities, students also learn to discuss and interact with each other and to work as a team. The organized laboratories allowed both the students to do the experiments supervised, as well as on their own or in small groups. The topics proposed through our laboratories can be summarized as follows:

- **Light and electromagnetic spectrum:** the students learned the “secret” of light and color, as well as the properties of refraction and reflection, and they understood why sometimes they see rainbow and why the sky turns red at sunset.
- **Waves: Sound and light:** these activities were dedicated to waves and the description of their characteristics. A comparison between sound and electromagnetic waves was proposed to understand their similarities and differences.

- Supercool Physics: these activities were based on the use of liquid Nitrogen and allowed to see the effect of very low temperature elements ( $-200\text{ }^{\circ}\text{C}$ ) on room temperature objects, while also explaining pressure and Leidenfronst effect.
- Kitchen physics: For doing science it is possible to use a lot of objects present in our kitchen. The students had the possibility to measure the speed of light using a microwave oven and to understand pressure effect using an orange.

For high-schools, seminars about Modern Physics and its applications were organized. The themes ranged from what an elementary particle is and how detectors “see” it as well as other areas of physical inquiry (from health physics to science philosophy) as well as other physical areas and prospects of careers in science starting from the researchers’ own experience. Pictures from the school activities can be found in Figure 1.



**Figure 1:** Pictures from school activities

### 2.2.3 Science Festival

Science Festivals are crucial moments for the interaction between citizens and researchers. As can be found in Section 3, researchers are still considered “outcasts” or not well integrated in the society, to such an extent that these occasions represent a great possibility to increase the society trust in science - a trust which is pivotal for the development of our countries. During the last year of activities, the GRaffa project participated in several outreach events sponsored by its supporters (Frascati Scienza and National Laboratories of Frascati): hands- on laboratories and seminars were organized. Pictures from the public events can be found in Figure 2.

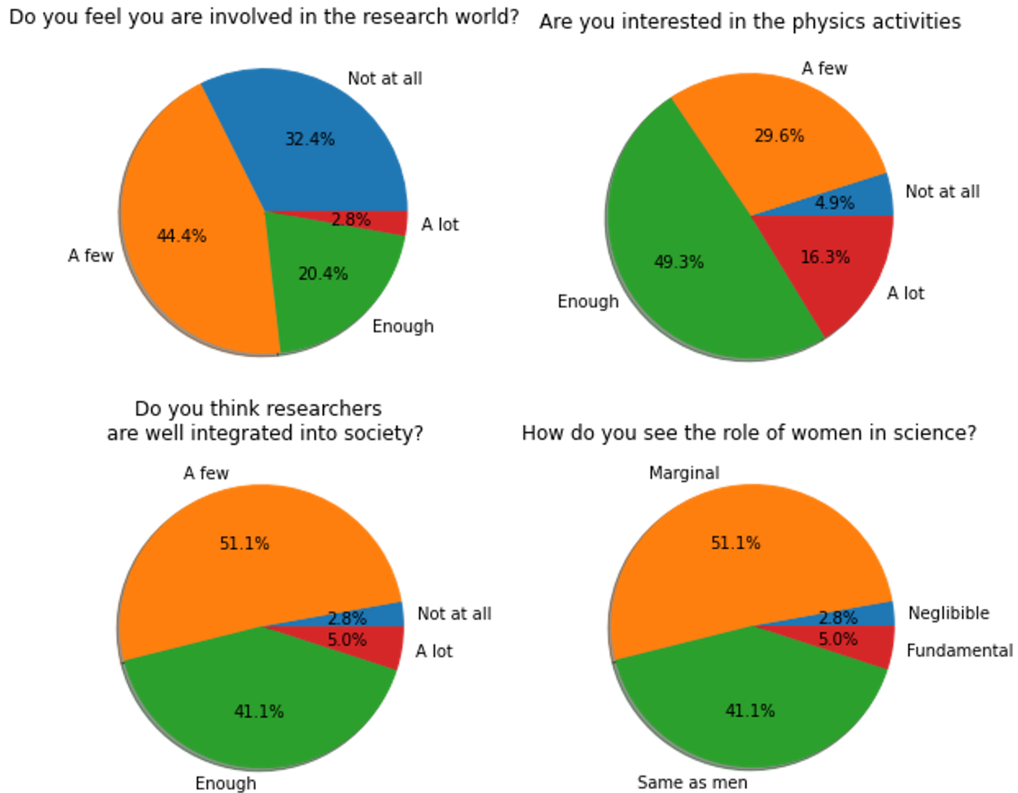
## 3. Students survey

At the end of each activity in the schools, the participants were asked to fill out a very brief survey that allowed the Association members to understand the young generation point of view



**Figure 2:** Pictures from public events attended

about physics and the potential existence of preconceptions or stereotypes about the researcher job. Some of the results obtained can be found in Figure 3.



**Figure 3:** Results obtained from the survey filled out by students

More than 1000 answers have been collected during the 2021-2022 school year: ~ 90% of the sample is composed by students and the remaining are teachers. 4.9% of the sample is less than 14 years old, 78.2% is between 14-18 years old and ~ 17% is more than 20 years old. From the survey and personal discussion with the students it was clear that researchers are somehow seen as “outcasts/weirdos”, and students thought that having researchers in class with them was a good opportunity to understand what is the contribution that physics offers to society. Moreover, one point clearly underlined by teachers is that poor budget allocated for science activities represents a crucial difficulty in strengthening science education. Finally, even if young girls find STEM a difficult path, they are interested in studying these subjects at university.

#### 4. Conclusion

After only one year of activities, the Associazione Giovanile Le Scie Fisiche has obtained quite remarkable results. The group finds in social network an important means to communicate physics and to promote scientific knowledge in a simple but still catching way, offering a positive example against gender stereotypes. The group participated to important outreach events such as the European Researchers Night and the International Day of Women and Girls in Science. Moreover, the growth possibility offered by the grant won laid the foundations for future science outreach initiatives both in Rome and in the entire Lazio Region.

#### References

- [1] 2022 European Researchers' Night website <https://marie-sklodowska-curie-actions.ec.europa.eu/event/2022-european-researchers-night>
- [2] Laboratori Nazionali di Frascati website <https://w3.lnf.infn.it>
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- [5] E. Diociaiuti et al, (2022) *GRaffa: a scientific communication project by young researchers for very young people*, EDULEARN22 Proceedings, pp. 2018-2025.
- [6] Associazione Giovanile Le Scie Fisiche web page <http://sciefisiche.it>
- [7] Associazione Giovanile Le Scie Fisiche YouTube page <https://www.youtube.com/channel/UC6xHthruUvn1ZCNJHE-cd5w>