Highlights of Spanish Astrophysics XII, Proceedings of the XVI Scientific Meeting of the Spanish Astronomical Society held on July 15 - 19, 2024, in Granada, Spain. M. Manteiga, F. González Galindo, A. Labiano Ortega, M. Martínez González, N. Rea, M. Romero Gómez, A. Ulla Miguel, G. Yepes, C. Rodríguez López, A. Gómez García and C. Dafonte (eds.), 2025

National Eclipse Commission - Proam Collaboration and Citizen Science

Ordóñez-Etxeberria, I.[1],

[1] Planetarium of Pamplona

Abstract

This contribution examines the opportunities for implementing professional-amateur (Proam) collaboration and citizen science projects during the solar eclipses of 2026, 2027, and 2028 in the Iberian Peninsula. These initiatives not only enable the collection of valuable scientific data but also engage the public in the scientific process, promoting education and outreach. Several research proposals are presented, focusing on atmospheric meteorology, animal behavior observation, ionospheric studies, solar corona analysis, and the physiological impact on humans. Each proposal is based on previous project models that have demonstrated effectiveness, ensuring their feasibility within the Spanish context.

1 Introduction and Context of Eclipses in the Iberian Peninsula

In the coming years, the Iberian Peninsula will experience a series of unique astronomical events: the solar eclipses of 2026, 2027, and 2028. These phenomena present an exceptional opportunity for scientific research and public outreach, especially through collaborative projects between professional astronomers, amateurs, and citizens. The National Eclipse Commission, supported by the National Astronomy Commission, was established to manage, coordinate, and advise both scientific institutions and local and regional authorities, on the implementation of scientific and educational activities during these events.

2 Challenges in Tourism, Transportation, Education, and Civil Protection

Projections suggest a significant increase in the influx of both national and international visitors to the areas with optimal viewing conditions. This tourist flow requires careful management in areas such as transportation, accommodation, and civil protection. The economic

impact is expected to be substantial for the tourism sector, but also requires thorough planning to avoid congestion issues and ensure safety. Previous studies in other countries have demonstrated the importance of preparing local communities through education and awareness campaigns. Additionally, the educational and scientific sectors in Spain will need to implement effective strategies to raise public awareness about safe viewing and leverage these phenomena as educational tools.

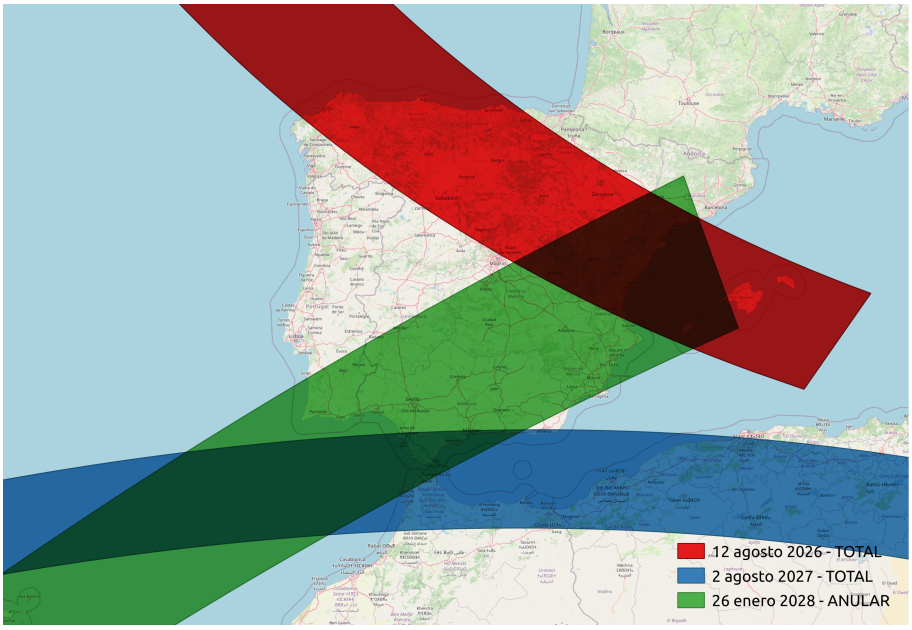

Figure 1: Distribution across the Iberian Peninsula of the bands of totality and annularity for the solar eclipses of 2026, 2027, and 2028.

3 Proposals for ProAm Collaboration and Citizen Science Projects

3.1 Network of Meteorological Stations for Studying Atmospheric Effects

The creation of a network of meteorological stations represents a great opportunity to study the effects of solar eclipses on local weather. During an eclipse, the temporary reduction in solar radiation causes measurable changes in parameters such as temperature, atmospheric pressure, and wind speed. Inspired by the National Eclipse Weather Experiment (NEWEx) [1], this proposal aims to replicate the success of international projects on Spanish soil, installing stations at key locations to collect meteorological data before, during, and after the eclipses. Citizen participation is essential to achieve wide geographical coverage, involving students, teachers, and amateurs in the measurement and analysis of these phenomena. This approach not only facilitates a better understanding of meteorology during eclipses but also fosters scientific literacy through active participation.

3.2 Observing Animal Behavior in Response to Changes in Natural Light

The abrupt changes in light and temperature accompanying an eclipse provide a unique opportunity to study animal behavior. In particular, this proposal is based on the model of the Life Responds project, which has shown how animals alter their activity patterns and behaviors during unusual astronomical events. In the Spanish context, citizens will be invited to record observations of wildlife in rural and urban areas, using mobile applications for real-time data logging. This project will yield relevant data for ethology while involving the public in an educational experience and fostering awareness of local wildlife.

3.3 Ionospheric Analysis with Radio Amateurs (HamSCI)

Solar eclipses affect the ionosphere, a layer of the atmosphere critical for radio wave transmission. The reduction in solar radiation during an eclipse alters ionization in the ionosphere, which, in turn, influences radio wave propagation. In collaboration with the HamSCI (Amateur Radio Science Citizen Investigation) project, ionospheric data will be collected through the collaboration of radio amateurs across the country. The data generated by participants will be integrated into a centralized database, allowing scientists to analyze ionospheric variation patterns, facilitating a better understanding of eclipse effects on communication and Sun-Earth interactions. This project also promotes learning in radiofrequency techniques and the use of communication technologies among the general population.

3.4 Studying the Solar Corona with the Citizen CATE Project

The solar corona is a key area of interest in astronomy and can only be observed during a total eclipse. The Citizen CATE project allows citizens and educational centers to capture high-resolution images of the solar corona during the eclipse. These images will be fundamental for studies of coronal dynamics and structure, contributing to our understanding of phenomena such as the solar wind and coronal mass ejections (CMEs). The proposal includes training for teachers and the creation of educational resources, enabling schools and cultural centers to actively participate in data capture and analysis. This initiative also helps raise awareness among young people about the importance of solar research in the context of space weather.

3.5 Assessing the Physiological Impact of the Eclipse on Human Health

Finally, a project has been proposed to assess the physiological impact of eclipses on humans, leveraging widespread access to devices like smartwatches. The project involves measuring parameters such as heart rate, blood pressure, and stress levels in participants before, during, and after the eclipse. This type of data will provide valuable information on how changes in brightness and temperature influence human physiology and whether common physiological responses occur in reaction to these phenomena. The results will contribute to the growing field of environmental psychophysiology, which examines the relationship between the environment and bodily response.

4 Discussion

The series of eclipses from 2026 to 2028 represents a unique opportunity for citizen science in Spain. These projects are based on previous models that have proven successful in other countries and similar contexts. ProAm collaboration offers significant potential to enrich the national scientific database, particularly in fields that require geographically dispersed or hard-to-access data. Moreover, citizen participation brings educational benefits, increasing public interest in astronomy and science in general.

5 Conclusion

The projects presented here demonstrate the commitment of the scientific and educational community in Spain to maximize the positive impact of the upcoming eclipses. The National Eclipse Commission will play a fundamental role in coordinating these activities, facilitating collaboration between professionals, amateurs, and the general public. Implementing citizen science and ProAam collaboration projects not only enables comprehensive data collection but also contributes to public awareness and scientific education. The eclipses of 2026, 2027, and 2028, therefore, will not only be events of astronomical interest but also a vehicle for collective learning and active participation in science.

References

[1] Barnard L, Portas AM, Gray SL, Harrison RG. The National Eclipse Weather Experiment: an assessment of citizen scientist weather observations. Philos Trans A Math Phys Eng Sci. 2016 Sep 28;374(2077)