‘Let Science come to your space’ - Delivering Astronomy and Optics outreach activities outside the cities

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INTRODUCTION

According to different research, over the last few years, students have decreased their interest in Science, Engineering, Technology, and Engineering (STEM) studies worldwide[1]. Different countries worldwide are conducting projects to integrate STEM to promotes creativity, inquiry, dialogue, collaboration, critical thinking, experiential learning, and problem-solving[2].Moreover, Latin American countries are measuring the quality of primary education in rural communities and towns outside the metropolitan areas, concluding that inequality, inequity, and the typical results in most cases[3-7].

This work presents the summary of a multidisciplinary project where teachers, students, and technical staff of the Facultad de Ciencias Físico Matemáticas worked together to conduct science events in different facilities all over the state of Nuevo León and, in collaboration with other research groups, in different states of México.

METHODOLOGY

The department of the Mobile Planetarium of the Facultad de Ciencias Físico Matemáticas (FCFM) is integrated by technical staff dedicated to astronomy and the outreach group ‘Physics for Everyone' is an academic group that was born as an evolution of the SPIE and OPTICA student chapters, where students, teachers, alumni, and early career volunteer to perform optics and physics demonstrations, using, in most cases, low-cost materials and conducting activities in public spaces of traveling to schools in the area[8,9].

The project began in 2017 due to the partial solar eclipse. The project `Let the science come to your space' conducted the following activities

- Contact public schools in the different towns of Nuevo León
- Train teachers and undergraduate students to perform safe solar observations
- Contact other science outreach outside Nuevo León
- Organizing the public observation of the Solar Eclipse in October 2017 simultaneously

After the success of the Solar Eclipse observation of 2017, the project was consolidated and structured as follows:

- **Undergraduate students training.** Teachers, researchers, and technical staff train volunteer students in telescopes, solar observation, general optics, optics outreach, public communication, storytelling to explain science, and astronomical photography.
- **Big public events.**
- **Visiting towns and rural communities.**

Public Events

The public events performed in different cities and towns of Nuevo León include:

- Mobile planetarium
- Solar observation for day events
- Sky observation and use of the telescopes for night events
- Electromagnetism demonstrations to understand the nature of Light
- Optics demonstrations and workshops based on ‘Dumpster Optics' project[10]
- Other STEM demonstrations

All the events include the participation of students and early careers professionals to create accurate role models of women and men performing science activities, where the diversity in gender and age of the volunteers makes more manageable for the public to feel identified and to consider pursuing a career in STEM fields[11].

ACKNOWLEDGMENTS

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RESULTS

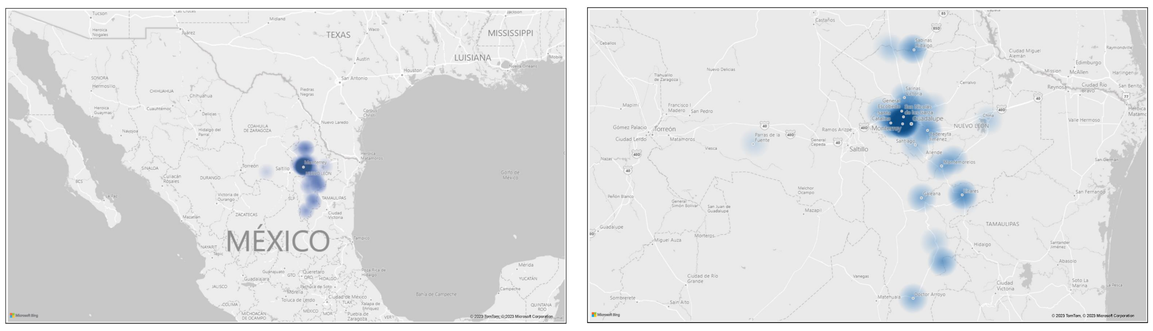

Figure 1. With over 80 events in over 60 cities and municipalities, we have reached around 68,000 attendees in Nuevo León. As seen in the figure, the highest density is in Monterrey and its metropolitan area, as it is the closest area to our University

Year	Attendees	Number of events
2017	17,184	27
2018	15,910	13
2019	15,453	18
2020	9,027	6
2022	10,304	20
Total	**67,878**	**81**

Table 1. Total number of attendees benefited from this program.

Figure 2. Some pictures of different events over the years.

FCFM-UANL has sought to bring knowledge and interest in physical, mathematical, and computational sciences to the population and elementary and upper secondary education students through scientific events. The program has grown since its inception in 2017, reaching both urban and rural areas of Nuevo León with the support of participating municipalities and schools. Table 1 show the number of events held annually and the impact this program has had on outreach. Figure 1 presents the map of the localities that benefited from this program, which covers a wide area of the state of Nuevo León. Likewise, the Universidad Autónoma de Nuevo León has expanded the number of high schools in rural areas. Figure 2 shows the program's impact on different municipalities where optics and solar observation activities have been carried out. The program aims to contribute to bringing STEM activities closer to communities.

CONCLUSIONS

Thanks to the project we found some interesting effects”

- A rise of 10% of the Physics students in our Faculty and an increase of 15% of all our careers.
- An increase of 20\% of the students coming from towns and rural communities in Nuevo León.
- A creation of 2 new student outreach groups supporting the project.
- Our Faculty opened a new campus on the Northwest of Nuevo León
- Undergraduate students involved in the project are now supporting new projects such as the new Museum of Sciences of our Faculty and the 'Scientific Turism' project
- Former program volunteers are now conducting educational programs in different institutions in Nuevo León.

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