

## **The Living Astronomy and People of the Mayan World Today – Engaging Hispanic Populations in Science**

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**Abstract** From long ago, the Maya civilizations of Mesoamerica have been keenly attuned to the cycles of nature. The Maya have always been careful observers, and more than a thousand years ago, they recorded the motion of the planets, the Sun, and the Moon, and predicted eclipses. These observations were used to create a complex calendar to organize the events of their world. The Maya built great cities containing buildings aligned with the Sun, Moon, and the stars to mark important times of the year. Many astronomical traditions are still practiced today by the Maya of the Yucatán peninsula, Southern states in México, and other areas in Mesoamerica. Traditional farming communities time the cultivation of corn by observing the sky. The living culture of the Mayan people in the Yucatán integrates science and astronomy with every other aspect of their culture. Yucatec Maya, the language spoken by more than 1 million people in the Yucatán today, still carries through oral histories the ancient knowledge of nature. Our hope is that you'll increase your interest and knowledge of the Mayan people and of the enduring wisdom reflected in the daily lives of Mayan families. We present the results of education and public outreach efforts that position astronomy within its cultural context as an effective means of capturing the interest and enabling authentic participation of under-represented populations in science.

### **1. Introduction**

Humans across all cultures have venerated, observed, and studied the Sun, the Moon, the planets and the stars for thousands of years. The Maya developed astronomical tracking systems and detailed calendars spanning many generations. Astronomical knowledge is reflected in the architecture of ancient buildings in thousand-year-old archeological sites and monuments in México, Guatemala, Honduras, and other areas of Mesoamerica. In addition to amassing a great body of astronomical knowledge, the Maya developed a complex system of mathematics that used the concept of zero. They recorded their knowledge in bark accordion-like books or codices using a writing system of glyphs. They observed the motions of celestial bodies in the sky for the purpose of planning and celebrating key dates in their ritual calendar including for purposes of agriculture. Many of these astronomical traditions are still practiced

today by traditional farming communities that time the cultivation of corn and other crops by observing the movements of the Sun and the stars.

The strong and rich astronomical traditions that still thrive in the Mayan community throughout the world can provide a framework for Hispanic communities in the United States to integrate contemporary astronomical knowledge with worldviews that are grounded in thousands of years of tradition. For example, in the San Francisco Bay Area, there are more than 30,000 Yucatec Mayan immigrants who are keenly interested in participating in science and technology but have not found an easy entry point. Among the most under-represented groups in science are Hispanic-Americans. Of all working scientists and engineers, less than 4% are Hispanic (AIP 2005). Disconnection from scientific fields, both in terms of access to concepts and knowledge, and opportunities in education and research, are important factors that contribute to the low numbers of Hispanic-Americans in scientific and technical careers. Hispanic youth in particular fare poorly in math and science achievement, even though large numbers of the US Hispanic population come from a rich indigenous heritage that includes a wealth of knowledge about botany, astronomy, mathematics, engineering, ecology, etc. (Fixico 2000; Snively & Corsiglia 2001). By highlighting the astronomical legacy and current astronomical practices of the Mayan culture in the Yucatan, we have been able to collaborate with community based groups of Mayan immigrants in California to attract and engage youth and their families in contemporary astronomy and science.

## **2. Science Festivals with and for the Mayan Community in California**

Working with the Mayan community leadership in California, we have implemented implement six community and family science festivals since 2005. The one-day, week-end events are free of charge to the general public, and attract on the order of 500 people. The festival includes: talks by NASA and other scientists, educators, and native and non-native experts on the astronomies and mathematics of indigenous cultures; presentations by members of the Hispanic community especially elders and others who can share oral traditions; science activities for families mainly focused on the Sun since the festivals take place during the day; solar telescope viewing; hands-on activities related to solar energy; cultural demonstrations such as traditional dances, arts and crafts; and traditional food. Mayan community leaders partner with UC Berkeley to plan and coordinate the festivals, and receive support in the form of seed funding and access to NASA materials and content expertise. Community participation is keenly dependent on their established relationships with community leaders, thus the recruitment of participants is led by the Mayan community groups. Community leaders tap existing infrastructure for dissemination such as Mayan language radio, flyers and Internet communication in Yucatec Maya and Spanish, and by word of mouth. UC Berkeley provides follow-up support through ongoing communication and sharing of appropriate resources and science opportunities for families in their neighborhoods.

### 3. ASP Conference Session

To best demonstrate the spirit and characteristics of the community science festivals, our presentation at the ASP involved 10 members of the Mayan community in San Rafael, California, who have been instrumental in the planning and implementation of the program. The participants included the group's Grandmother, Doña María Oliva Díaz, who began the presentation speaking in her native Yucatec Mayan language, introducing her family and the two authors of this paper (Felipe Tapia and Isabel Hawkins). Subsequently, the authors gave a brief presentation of Mayan astronomy and summarized the community events in California. A Q&A session focused on the living knowledge of astronomy in the Mayan community today. To demonstrate the activities during the events, the Díaz family facilitated small groups in the audience who participated in demonstrations of the types of astronomy hands-on activities done at the festivals (e.g. construct a solar clock; experiment with UV detecting beads; discuss Mayan language and astronomy using a print resource; explore the magnetic nature of the Sun using a magnetism kit; participate in a demonstration of the Sun-Earth size and distance scale model; and play with solar energy toy cars, etc.). The session ended with a traditional *Jarana* dance demonstration by Felipe Tapia and three of the Díaz children, who were dressed in their elegant *huipiles*. The presentation highlighted program characteristics that were identified as important elements of our collaboration by the Mayan community leaders themselves:

- The program enables the Mayan community to take initiative and become self-motivated to learn about our own scientific and cultural legacy.
- The program disseminates Mayan knowledge of astronomy and science to our own Mayan community and to the world, in a way that assures authenticity, integrity, and accuracy.
- The festivals serve as an example to other indigenous groups so they can also research and learn about their own astronomical legacy, for example, Zapotec and Mixtec immigrants in California who came from Oaxaca, México.
- Astronomy makes science in general more accessible to our children.
- Our project takes into account the daily activities and cultural expressions of our community to attract their participation.
- The program talks and activities include many themes related to the Sun and astronomy that highlight science in general, making connections to the living knowledge of the environment and the sky by Mayan people today.

### 4. Program Evaluation

The program's impact in attracting and engaging Hispanic communities of Mayan heritage in astronomy and science has been evaluated by *Contemporánea*, an independent marketing and evaluation firm in San Francisco. Results indicate that the program is being received extremely well by the Mayan community in California, and that the program succeeds in providing access to science and astronomy in a cultural context that resonates with indigenous people of Mayan descent. Specific results include:

- Children and adult festival participants agree that they are **highly interested in learning more about astronomy**. Children were highly interested in attending the program in the future and asked that it contain even more activities.
- These events were successful at **linking new concepts to participants' existing knowledge** base. These participants, many of whom were Maya, had fundamental knowledge of science, astronomy and the accomplishments of the ancient Maya; however all agree that these programs added new layers of information and new scientific concepts to this foundation.
- **Perceptions of personal Maya heritage were strong** among attendees. In describing the contribution of their ancestors, many participants spoke with pride, using the collective “we” and “our.” Many feel that much of today’s Maya culture and everyday life continues to reflect this rich heritage. Respondents say they use this knowledge, even today, for agriculture and to check the time or weather.
- The program was particularly effective at boosting **perceptions of access**. Attending the festival events generated excitement and awareness that there are avenues to astronomy and scientific content.

By providing opportunities for the Mayan community in California to increase their knowledge and appreciation of their culture’s scientific legacy and their current astronomical practices, our community events are increasing and facilitating access to science, mathematics, and technology for Hispanic children, youth, and families.

## References

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