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Under one Arkansas sky: bridging science and community in rural America

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The 2024 total solar eclipse offered a rare opportunity to connect world-class space scientists with communities in rural America. Here, we reflect on a grassroots outreach event held in Dardanelle, Arkansas, a small farming town located along the path of totality. Nearly one hundred participants including NASA and university affiliated scientists, engineers, educators, students, and local residents gathered to witness the eclipse together. Visitors conducted scientific demonstrations, hosted a star party, and carried out a successful eclipse observation experiment. These activities provided authentic, personal encounters between scientists and the public, fostering curiosity and trust in a region rarely engaged by NASA programs. Drawing on this successful experience, we recommend that future scientific funding agencies expand their outreach efforts by direct partnering with small towns, collaborating with local libraries, and involving scientists with rural ties. These strategies broaden the direct community engagement with real scientists across the United States helping them to develop a scientific identity and a sense of involvement with the space sciences.

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Arkansas, eclipse, heliophysics, outreach, rural, science, solar

1 Introduction

On 8 April 2024, a total solar eclipse crossed North America, spanning the contiguous United States. In the years leading up to the eclipse, NASA promoted the event and “The Heliophysics Big Year” (Cermak, 2022). Our scientific community wanted to make Heliophysics, or the study of the Sun and its influential reach in our Universe, a household term. The public was invited to participate in events and Sun-related activities from October 2023 through December 2024. This included the total solar eclipse.

Along the path of totality sat a small farming town located in Yell County, Arkansas: Dardanelle. With a population of roughly 4,500, where fewer than one in six residents hold a bachelor’s degree or higher, and a rich yet often heartbreaking Native American and American Civil War history, Dardanelle is not the kind of place that typically makes it to the outreach map of any funding agency (U.S. Census Bureau, 2023).

However, just across the Arkansas River lies Russellville, which is home to Arkansas Tech University and the State’s only nuclear power plant, Arkansas Nuclear One. This proximity to both higher education and advanced energy research makes the region a natural, if

overlooked, intellectual hub for conversations about physics, energy, and the Sun's influence on our planet.

Dardanelle itself also has much to boast beyond its historical sites. It is home to Mount Nebo State Park, with its world-class mountain biking trails and sunrise and sunset overlooks. The citizens of Dardanelle are, in their own way, students of the Sun as they often visit the top of Mount Nebo to watch it rise and set.

Then, down in the valley, sits a midcentury modern farmhouse with an unobstructed view of the skies. It was here that nearly 100 people came together to witness the fantastic celestial event that was the 2024 total solar eclipse. From world-class scientists and engineers, their families, locals from Dardanelle and the greater Arkansas community, firefighters, science writers, international colleagues, and beyond; we spent a weekend together connecting over good food, the natural beauty of Arkansas, and our shared wonder of our place in the universe.

The eclipse experience in Dardanelle showed each of us that it is possible to connect underserved regions like Arkansas with world-class science communities. By establishing more accepting mindsets from both science and rural communities and engaging more individuals from these underserved regions, NASA can extend its reach to the American people who may not have access to its current programs.

In this paper, we cover the different activities that took place at the farmhouse over the weekend and reflect on the impact of hosting the viewing event in a small American town. Any first person (“I, me, my”) remarks are made by the first author. We then look forward based on our successful outreach event to share our experience as a recommendation for how funding agencies can involve communities like the one in Dardanelle, Arkansas, in future events.

2 A farmhouse in Dardanelle, Arkansas

Dardanelle, Arkansas, offered one of the longest viewing locations of the 8 April 2024, total solar eclipse. Totality lasted over 4 min and 10 s, compared to the State capital of Little Rock where totality lasted under 3 min. It was for this reason that we chose to base our eclipse viewing activities in Dardanelle.

The farmhouse also provided the space necessary to host many people for the weekend and on the day of the eclipse. Nearly 100 people of all ages and backgrounds joined in our eclipse festivities. Roughly 60 of the attendees were local to Arkansas, while the others traveled from out of state to the area. Science colleagues from the Laboratory of Atmospheric and Space Physics (LASP) at the University of Colorado, Boulder, Space Sciences Laboratory (SSL) at the University of California, Berkeley, the NSF National Center for Atmospheric Research (NSF/NCAR), Blue Origin, *Sky & Telescope* magazine and beyond came for the event. Friends and family members from around the country, past teachers, neighbors, and local community members also attended the viewing. For one weekend, the quiet home turned into a retreat for science and the community.

This retreat became a collaborative effort between scientists and locals. It started as a small gathering of close family, friends, and neighbors local to the area. Scientists from around the country decided only a few days before the event to view the eclipse from

Arkansas due to poor visibility forecasted in many other areas around the country. The coordinator sent an email to potential attendees with event logistics, local context, and house guidelines, designed to set clear expectations and intentionally cultivate a safe and welcoming environment.

As the number of potential attendees grew, local farmers donated 12 dozen eggs and other fresh foods to feed the group, symbolizing small-town generosity and participation. Meals were prepared communally, blending the science “field-camp” logistics with Southern hospitality. Families and children helped set up equipment and tents, while informal activities like fishing and walking barefoot created a relaxed, welcoming environment. This strong local involvement and connection to the landscape made the event feel truly rooted in Dardanelle.

Meanwhile, Dardanelle and neighboring Russellville conducted their own celebration events at local parks, establishments, and at Arkansas Tech University (ATU, 2024). Expectations were high for the number of people set to attend the eclipse viewing, and the local municipalities and Arkansas Tech students put together plans to accommodate a possibly large number of visitors (Buckner, 2024). The Dardanelle farmhouse was part of this state-wide moment of unity.

This retreat showed that science can merge with local culture without barriers or pretense. This informal, human-centered engagement fostered psychological safety where locals could ask questions freely, laugh, and participate in science activities without fear of judgment. At the same time, novel science research was able to be accomplished pertaining to the eclipse. For this one weekend, Dardanelle was at the heart of national science.

3 Science and educational activities

The weekend in Dardanelle was not only a time for connection but also for discovery. Several scientific and educational activities took place at the farmhouse and in nearby locations, as shown in Figure 1. Different teams brought their expertise, ranging from heliophysics to grade school education. This provided a unique lens through which to view the eclipse event.

A Blue Origin engineer with experience leading planetarium shows hosted a star party the night before the eclipse. With a green laser pointer, she guided the guests around the night sky and named the visible constellations. This made space and astronomy personal; something everyone could experience and learn about in their backyard. It also primed the guests for the event they would witness the next day.

Sky & Telescope associate editor Sean Walker photographed the eclipse with camera lenses and a telescope with the goal of revealing details in the solar corona including the Sun's complex magnetic fields, which help trace the movement of solar particles from its surface out into space. He shared the view with attendees, empowering them to see several visible sunspot groups before they were covered by the Moon's silhouette. His images and reporting from the event were featured on both *Sky & Telescope's* website as well as in the magazine's August issue, reaching several hundred thousand unique readers (Walker, 2024). Through that coverage, Dardanelle, a small Arkansas town seldom mentioned in science media, became a symbol of what can happen when space-affiliated



FIGURE 1

Images of the total solar eclipse and pertinent activities in Dardanelle, Arkansas, and the surrounding areas. Visitors were able to interact with scientific experiments and view the eclipse through solar telescopes. A star party was held the night before, pinhole projectors were made to view the stages of the eclipse, and the surrounding area decorated the streets with art and signs related to the eclipse event. *Eclipse images courtesy of Sean Walker.*

professionals step outside traditional academic settings and bring their work directly to the public.

Researchers from the National Science Foundation (NSF) National Center for Atmospheric Research's (NCAR) High Altitude Observatory (HAO) led a field experiment on-site. The results from Coronal Helium Emission Spectrograph Experiment (CHEESE) were published in [Molnar et al. \(2025\)](#).

The CHEESE experiment was designed to solve a long-standing solar mystery: why do we sometimes see neutral helium

in the Sun's outer atmosphere when it should be too hot for helium atoms to exist there ([Kuhn et al., 1996](#); [Molnar and Casini, 2024](#)). Using a small, custom-built instrument made mostly from off-the-shelf parts, the team observed the 2024 total solar eclipse and successfully detected the helium signal, along with nearby hydrogen lines. Because CHEESE used portable equipment, it demonstrated that meaningful solar research can be done almost anywhere, even from a farmhouse field in Dardanelle, Arkansas.

Participants at the Dardanelle event were able to interact with the CHEESE team and look through their telescopes, taking part in the on-going research. The team also set up an outreach tent with educational resources and solar-eclipse themed activities.

These activities during the eclipse weekend provided exposure for students and local residents to space-oriented professionals. Opportunities to engage directly with scientists, whether through hands-on activities, informal conversations, or observation of real experiments, can contribute to the development of a student's science identity, or sense of themselves as a "science person" (Chen et al., 2021; Ofek-Geva, 2025).

Building science identity has been shown to increase students' sense of belonging, confidence, and persistence in STEM fields. This sense of identification is particularly crucial for individuals from groups historically underrepresented in science, including those from rural areas, lower socioeconomic backgrounds, and minority communities (Chen et al., 2021).

As Aschbacher et al. (2010) noted, personal experiences and interactions across home, school, and community environments strongly shape how young people come to see science as "for them." Encounters with real scientists, such as those that occurred during the Dardanelle eclipse experience, can humanize the scientific enterprise and foster a greater sense of trust and accessibility. For many students and community members in Arkansas, meeting professionals from NASA-affiliated institutions, NCAR, and private industry may have been their first tangible contact with the space sciences. When asked if she had ever met a NASA scientist before, a participant responded:

"No, we do not have anything like that around here ... We're exposed to cows and chickens and stuff around here ... I'm in awe of the people that are highly educated, but they still talk normal to [people] even like me."

- Janie Scott

In moments like the Dardanelle eclipse, science shifted from a distant abstraction to something tangible, personal, and local. As Ms. Scott said, "that is what makes things so interesting, is when you can understand it on your level."

Encounters like these do more than impart knowledge; they awaken curiosity. One young participant asked:

"Are the sun and moon the same size? What is the ring of fire? Why did the dogs start barking all of a sudden and the birds fly away? How did they know?"

- Will, age 8

That same participant now has a framed picture of the 2024 eclipse event in his bedroom.

The opportunity to ask questions freely, without fear of judgment, nurtures both wonder and understanding. And as participants come to see themselves reflected in the practice of science, appreciation deepens into belonging. In this way, experiences like the Dardanelle eclipse weekend serve as laboratories for cultivating science identity, especially in regions where such opportunities are rare.

4 Local and regional impact

The 2024 total solar eclipse offered Arkansas an unprecedented opportunity for visibility and economic growth. The Arkansas Department of Transportation estimated that up to 1.5 million visitors from out of state, and another half a million Arkansans would travel to the path of totality during the event (Arkansas Department of Transportation, 2023). Researchers at the University of Arkansas at Little Rock projected that \$48–105 million in value-added GDP for Arkansas, and between \$27 to \$60 million in increased income for Arkansans from heightened business could be generated by the eclipse event (Faller, 2024).

Many Arkansas schools closed their doors so students could participate in eclipse activities around the state (Arkansas Department of Education, 2024a). The Arkansas Department of Education provided suggestions for students to engage in eclipse-related learning activities and resources for educators (Arkansas Department of Education, 2024b; Arkansas Department of Education, 2024c).

Despite possessing the necessary accommodations, transportation networks, and coordinated community efforts to welcome significant numbers of visitors, the anticipated turnout did not materialize. Small towns, including Dardanelle, undertook thorough preparations, planning community events, equipping restaurants with specialized menus and increased supplies, and prompting residents to stock essential items in anticipation of disruption. Some potential attendees of the Farmhouse event opted not to attend due to concerns about traffic, crowd size, and post-event travel logistics.

As the Executive Director of the Dardanelle Area Chamber of Commerce remarked (private communication, 2025):

"Plans were made. But reservations? Not so much. We expected a lot of people. We did not get a lot of people."

Some areas in Arkansas successfully received incoming visitors for the eclipse. Arkansas State Parks reported approximately 200,000 visitors while Arkansas Welcome Centers reported more than 41,000 visitors (Eclipse Ambassadors, 2022).

However, these documented numbers were well below the 1.5 million expected visitors. The shortfall in visitor attendance raises important questions regarding the factors that deterred travelers and why, despite robust infrastructure and readiness, Arkansas did not experience the expected influx.

5 Breaking down the ivory tower: a two-way responsibility

The 2024 eclipse was a missed opportunity for both Arkansas and the broader scientific community. Despite the state's location along the path of totality and its potential to serve as a hub for outreach and collaboration, relatively few national science organizations or research groups chose to anchor events there. More could have been done to bring scientists to Arkansas and welcome them once they arrived. The responsibility for that absence lies on both sides: with the scientific institutions that remain clustered in established hubs, and with state and local leadership

that has not yet built the infrastructure or reputation needed to attract them.

Too often, NASA and the broader scientific community operate from an “ivory tower” mindset, concentrating outreach and visibility in areas already saturated with science culture. I have seen colleagues dismiss engaging in regions where cultural or political views may differ, regions that often do not have a robust scientific community (Langin, 2022; Woolston, 2022). This mindset not only misses opportunities, *it actively penalizes communities by reinforcing limited access to scientific spaces, practitioners, and conversation.*

But the responsibility does not fall on science agencies alone. Scientists rarely have ties to rural regions (O’Neal and Perkins, 2021; Saw and Agger, 2021), and *they often receive messages that these are not places where they or their ideas will be welcomed* (Krause, 2023; Cramer, 2022; Gauchat, 2012). Concerns about safety, identity, and belonging are real and should not be dismissed.

It is not enough to simply wait for scientists to arrive; communities like Arkansas must extend invitations and create conditions that make participation safe and worthwhile. That means investing in infrastructure, building partnerships, and cultivating environments where scientists and engineers know they will be respected and valued. By hosting regional science events, providing logistical support for visiting researchers, or fostering a culture that welcomes many perspectives, Arkansas can position itself as a place where scientists want to come, not just where they occasionally pass through.

The successful Dardanelle eclipse weekend showed what is possible when both sides meet halfway: scientists leaving their comfort zones, and local communities opening their doors wide. Together, these efforts can ensure that moments of discovery do not remain rare, but become part of everyday life in places too often overlooked.

6 Looking forward: recommendations for NASA and local communities

The 2024 total solar eclipse revealed how much potential exists when science and community meet in places that are rarely on NASA’s map. Going forward, NASA and other funding agencies should look beyond traditional hubs and flagship universities when planning public engagement. College towns often already have access to science outreach, but the smaller towns surrounding them, the ones where families shop, teach, and raise children, are sometimes overlooked.

NASA has made meaningful progress toward addressing these gaps through several programs designed to broaden access to science. Initiatives such as NASA My Library leverage public libraries as trusted community spaces for informal STEM engagement (NASA, 2024; Mitchell et al., 2020; LaConte et al., 2022), while the NASA-funded Eclipse Ambassador program sought to engage underserved communities for the 2024 eclipse (National Academies, 2025; Astronomical Society of the Pacific, 2024). More broadly, NASA Science Activation (Stoltz, 2023), including its Rural Educator Network, and the long-standing NASA Solar System Ambassadors program rely on educators, scientists, and volunteers to bring NASA science into classrooms and public venues across the country.

Despite these efforts, challenges identified in broader rural STEM education research remain relevant. Rural communities often lack equitable access to reliable digital infrastructure, which limits STEM engagement opportunities including virtual science experiences or online professional training for educators (NAS, 2024). Some rural districts and organizations may lack the capacity to identify funding opportunities, complete applications, or meet reporting requirements, creating barriers to participation even when programs exist (NAS, 2024). Furthermore, STEM learning in rural areas often depends on local partnerships and culturally relevant experiences that are not automatically generated by centralized programs (Fuller, 2024).

The Dardanelle eclipse experience highlights an opportunity to complement these national efforts with community-embedded outreach models. Hosting scientific events directly within rural towns, rather than inviting residents to travel to universities or science centers, reduces logistical, cultural, and psychological distance between scientists and the public. Funding agencies could encourage workshops, meetings, or informal retreats in underserved regions to increase scientific visibility, foster informal interaction, and affirm rural communities as active sites of learning.

NASA and other funding agencies should also actively seek the perspectives of individuals originating from rural and underserved regions. Scientists and engineers with personal experience in these communities offer invaluable insights into effective communication strategies, what messages resonate locally, and the specific barriers that may hinder engagement. These individuals may be able to help organize similar outreach retreats like the Dardanelle eclipse experience.

At the same time, local and state leadership play a vital role. During the 2024 eclipse, Arkansans expressed both excitement and apprehension, particularly surrounding concerns about traffic and large incoming crowds. Messaging that emphasized avoidance of roadways unintentionally limited opportunities for interaction between visiting scientists and local residents. By fostering curiosity rather than fear, future events can be framed as opportunities for pride, learning, and connection.

Local and state politicians can speak with their constituents about NASA’s presence and other outreach events and highlight that these government entities are meant to serve all Americans. Business owners and community leaders can help to lift their cities by embracing these events as opportunities to connect and learn. University staff can better promote their educational resources and engage in outreach to surrounding communities, such as the planetarium and portable planetarium available at Arkansas Tech University. Scientists from these regions can form bridges of communication between science and local communities (Gewin, 2023).

7 Conclusion

This perspective has reflected on the 2024 total solar eclipse experience in Dardanelle, Arkansas, where science professionals and local residents came together for a weekend of collaborative, retreat-style activities. Replicating such events in the future holds considerable promise for engaging underserved and rural communities in science outreach. By fostering inclusive participation and shared experiences, these initiatives can help cultivate a broader science identity across the United States.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

SS: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review and editing. KD: Conceptualization, Investigation, Methodology, Resources, Validation, Writing – original draft, Writing – review and editing. MM: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Resources, Software, Writing – original draft, Writing – review and editing. SW: Conceptualization, Data curation, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review and editing. TQ: Writing – original draft, Writing – review and editing. KG: Funding acquisition, Project administration, Writing – original draft, Writing – review and editing.

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Author TQ was employed by Blue Origin.

The remaining author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The author(s) declared that generative AI was used in the creation of this manuscript. Generative AI was used to edit this manuscript for grammatical errors and as a thesaurus.

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