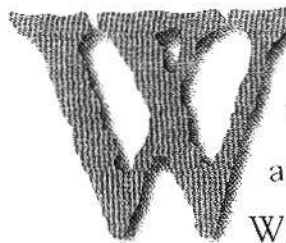


# Unlocking the Atmospheric Secrets of the Marfa Mystery Lights

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BY ED DARACK



est Texas: It is the land where pioneer legends and fantastic tales of the Wild West were created

under cloud-studded skies and deep-black nights. Here, where the brightness of the stars remains undimmed by civilization's lights, it seems only natural that a mystery involving atmospheric phenomena and extraterrestrials should evolve.

Planning a cross-country road trip a while back, my eyes lingered on the emptiness of West Texas on my roadmap: the Chihuahuan Desert, the widely-spaced and oddly named frontier towns, the lack of freeways. A few days later, with more than 1,000 miles of 4-lane highway in my rearview mirror, I broke free of the Interstate network at Van Horn, Texas, and headed south on U.S. 90, intending to skirt the United States/Mexico border before merging back onto the Interstate grid. As the shadow of dusk swept across a mile-high, wind-raked plateau, I aimed for a town named Marfa, urged there by my gas gauge. From Marfa I'd continue my exploration of West Texas into the far reaches of the Big Bend region of the Rio Grande.

Figure 1. The Chinati Mountains, with car headlights streaking over the high point of Route 67. In just a few seconds these lights will be visible to people at the viewing center 20 miles away, where they will see them twinkling and distorted due to the atmosphere.

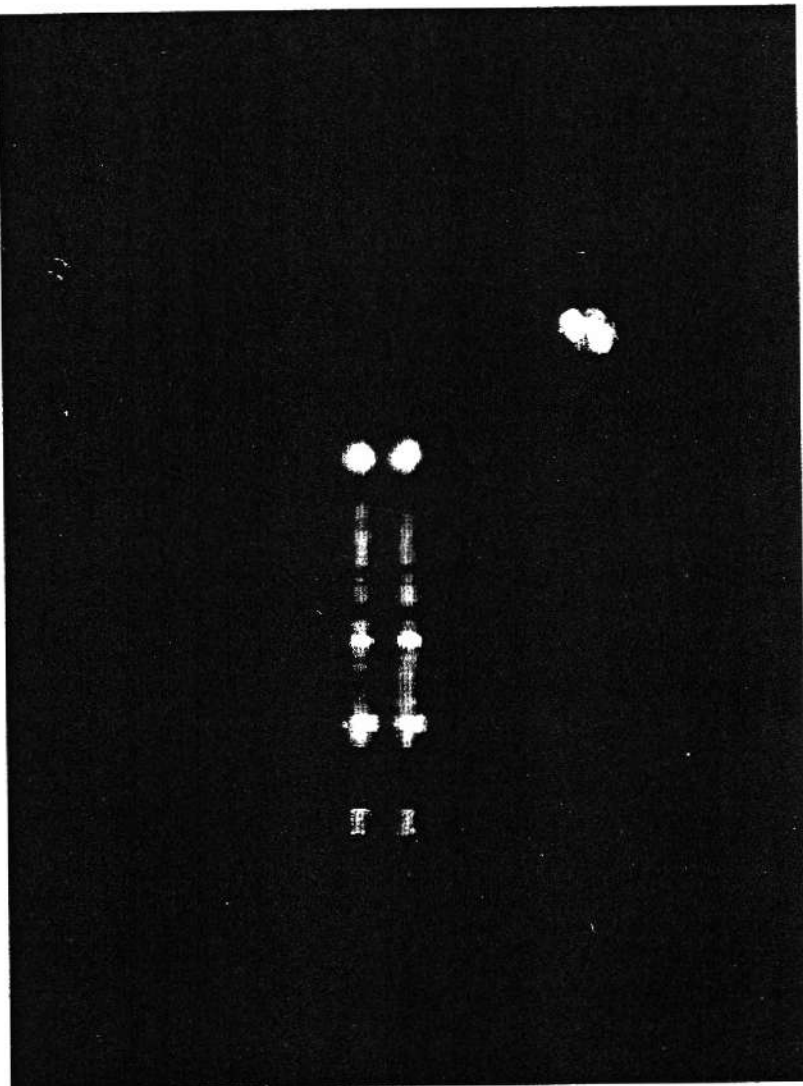


Figure 2. Out of the darkness lights emerge, expand, contract, and bounce about. When viewed through a long telephoto lens, the lights are revealed to be car headlights.

"You here for the lights?" A local rancher asked me as I topped off my tank a short while later, my bright white California license plate revealing me as an outsider.

"Huh?" I responded.

"The Mystery Lights. The *Marfa Mystery Lights*," he said. "Supposed to guide aliens and extraterrestrials and all that to come to Earth," he said with a smirk. "Right here, in Marfa! Gateway to Earth!"

"No. I don't believe in that kind of stuff," I responded.

"I don't either," he laughed. "You know what they really are?" he asked. I shrugged in response. "They're *car* headlights! On Route 67, south of here, connecting Marfa with Mexico! Still pretty interesting to look at, though. And hey, you're here just in time. Gettin' dark! Head on down the highway, 'bout 10 more miles. They got a viewing station on the right side of the road!"

"Right. Thanks."

"Welcome to Texas," the rancher continued, then, pausing, "welcome to *Marfa*, Texas!" I thanked him, bought some potato chips, and then split, immediately forgetting about the aliens and their purported navigational aids.

But those aliens jumped back into my thoughts not 10 minutes later as some mysterious lights popped into my field of vision. Miles to my south, out of the burgeoning darkness, a bluish-white flash snapped my attention and shifted it to thoughts of another world. I then glimpsed a sign from this world: MARFA'S MYSTERY LIGHTS VIEWING AREA, the block-lettered words announced as I blew past. I skidded my 1971 Volkswagen Bug to a halt at a small turnout just beyond the sign, then jumped into the cold January air. I stared intensely into the dark, squinting in an attempt to identify the source of the lights.

Car headlights, for sure, I thought. Headlights from far, far away. But wait! They suddenly jumped, split into two, and bloomed like a flower before my eyes. Then the lights shrank back to pinpricks in the night.

Bewildered, I tried to think of an explanation—a non-alien explanation. It must be a mirage or an atmospheric effect contorting car headlights. But I couldn't know for sure. I leaned against my car and gazed into the distance for a few more minutes. The mysterious lights waned. Then they disappeared. I jumped into my car and disappeared from Marfa myself.

Convinced that incandescent bulbs produce the photons that become the Marfa Lights—photons that the atmosphere's complexities then morph into legend and lore—I endeavored to learn more about what others had already discovered about the phenomenon. All I could gather, however, was a hodgepodge of theories attempting to explain the mysterious lights: St. Elmo's Fire, ball lightning, the ignition of emitted natural methane, rock-reflected moonlight, energized particles that rain down from the Van Allen Radiation Belts, a top secret Air Force project (a small USAF tethered balloon radar outpost lies just outside of Marfa), and all sorts of derivations and combinations of the aforementioned. In addition, other ideas about the source of the lights abound: alien landing lights (of course), ghosts, aliens themselves, time machines, maybe even Elvis.

## LOOKING BACK AT THE LIGHTS

Nearly a decade after my first Marfa experience, a group of University of Texas researchers descended upon Marfa, intent on identifying the source of the ghostly lights. The team carefully observed their amorphous subjects using a variety of tools, including video cameras and chase cars on Route 67. Their conclusion? The Marfa Mystery Lights

originate from incandescent bulbs—manufactured on Earth—mounted on speeding vehicles (also manufactured on Earth). Video clips of the lights, subsequently viewed at a high frame rate by the physicists, consistently showed them moving along the same path in the far distance: U.S. Route 67.

But, naysayers argue, dozens of newspaper articles reference “written documentation” of people who witnessed the lights as long ago as the 1880s, which predates both cars and Route 67, which was built in the early part of the twentieth century. Texas writer Michael Hall, in the course of diligent research, found that the earliest written documentation of the phenomenon appeared in a February 1945 *San Angelo Times* article titled “Ghost Light Appears in Marfa Area.”

Contrary to conspiracy theorists who frequent online message boards and use the so-called “written documentation” to boost their theories, there was nothing before that.

So just what makes these lights so much more remarkable than the countless highway lights beaming throughout the world at any given moment? The lights themselves aren’t remarkable, but the atmospheric lens through which visitors see these commonplace light sources can undoubtedly be described as far from ordinary.

Knowing that the atmosphere works in strange and complex ways, I wondered if mirages make the lights dance and bounce so mysteriously. It’s possible this is so, but in order to understand the Marfa Lights with any depth and accuracy, I found that I would need to enter the world not just of the mirage, but of the governing mechanism behind this atmospheric peculiarity: refraction.

## REFRACTION AT WORK

To refract light is to bend light. More specifically, refraction describes the bending of light rays upon passing through the juncture of two dissimilar masses (such as from air into water), or through the

juncture of two regions of the same composition but of dissimilar densities, such as when light travels through warm air into colder, denser air. Called atmospheric refraction, light traveling through the air constantly changes course, usually imperceptibly, but sometimes dramatically, depending on the magnitude of the change in density of air layers through which the light travels (light only travels in a straight line in a perfect vacuum or in a perfectly homogenous gas, which are conditions that do not exist outside of extreme deep space). Interestingly, due to terrestrial refraction, virtually every landmark before our eyes rests, in reality, just slightly offset from where we “see” that landmark.

The terminology and science of terrestrial light travel and atmospheric refraction can confuse and confound even the most ardent sky and weather enthusiasts, but most can grasp the abridged overview: light rays bend toward denser air during atmospheric refraction, and the greater the difference in density between two air masses, the greater the bending a light ray passing between those two air masses will undergo.

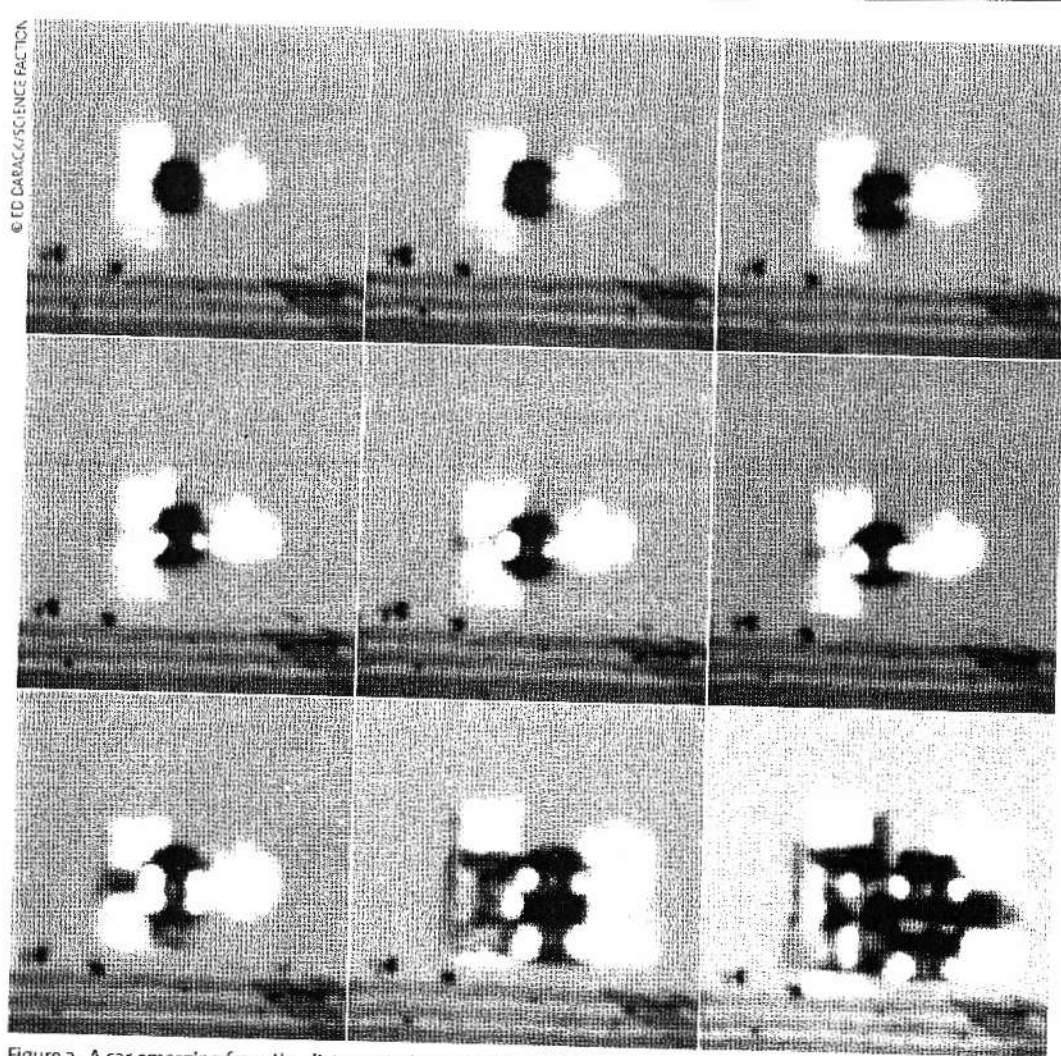


Figure 3. A car emerging from the distance is distorted by an inferior mirage.

## Photography Adds to the Myth

As with other phenomena that are associated with the “paranormal” or extraterrestrial, photography has fueled the flames of confusion and misinformation that envelop the Marfa Mystery Lights. Many of the photographs published and distributed of the Marfa lights were taken with telephoto lenses, and the lights actually occupy a very small portion of the scene—often just pinpricks of light in the expanse of darkness. But telephoto lenses magnify the size of an object relative to a film or digital sensor plane, so these pinpricks of light can be interpreted as occupying a larger portion of the horizon and can look like they are lower in the sky than they are in reality. In addition, vibration of the camera lens, the movement of the lights themselves, and the ever-changing “projection” of the light as it continuously refracts can also make the object appear larger than it actually is. My images that detail the effects of refraction of headlights were taken with an extreme telephoto lens, with a shutter speed 1/500th of a second or faster. Even with focal lengths that are equivalent to more than 1,000mm on a standard 35mm film plane, the “longest” mirages occupied just a small portion of the photograph. I used a Nikon 200-400 F/4 zoom on a Nikon DX format digital camera, yielding an equivalent of 300-600mm on a standard 35mm film area; with a 1.7x teleconverter used for some of the shots, I had an equivalent of up to a 1,020mm lens. Figure 2 represents the rare exception of extreme refraction, where a mirage “stretches” light over a large field of view. That shot was taken from the viewing center turnout before dawn, looking toward Paisano Pass. A fast shutter speed was used to prevent blurring.

Some photographers have made images of the lights by using long exposures, where headlights streak (as I have done with Figure 1 to illustrate how car headlights can look otherworldly), making them look much larger, longer, and

Can layers of air turn simple headlights into space ships? Of course not, but they’ll look something like extraterrestrial craft if the temperatures of the respective adjacent layers vary enough—creating strong temperature gradients—then those layers transform the headlights into the ethereal, the animated, and yes, even the mysterious.

### GEOMETRY IN MOTION

As I plunged deeper into my journey to unravel the science behind these mysterious dancing lights, I realized that a proper explanation must incorporate geometry as well—both the static geometry of the Earth’s curve as well as the dynamic geometry of the abundant and ever-changing layers of air through which light rays pass. The simplest of the Marfa geometry equations I could formulate involved a

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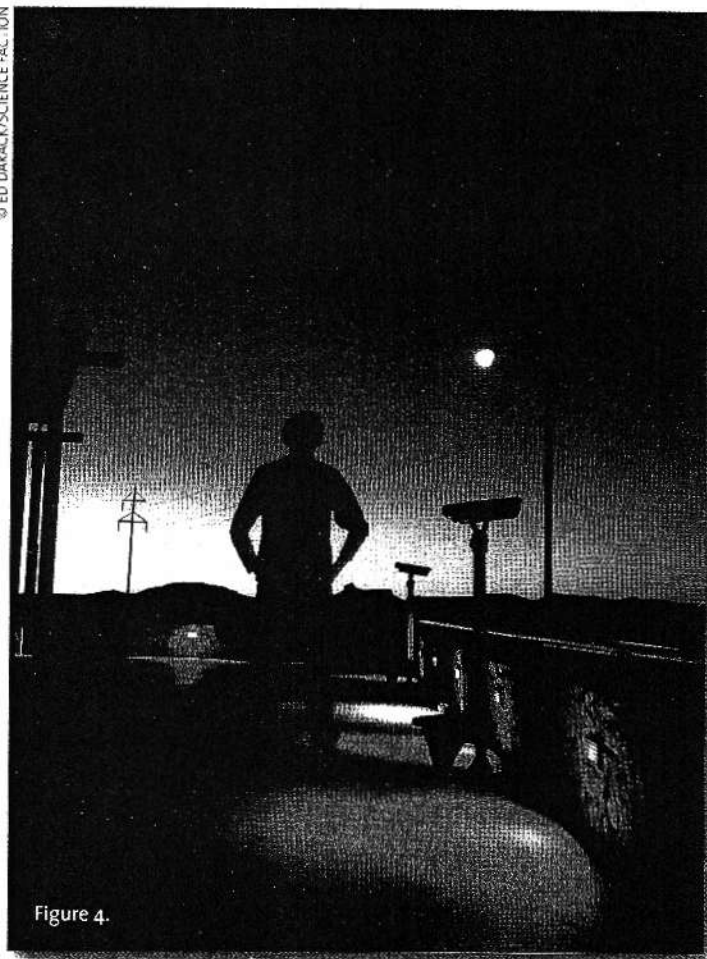


Figure 4.

more spaceship-like than they would appear in reality. Also, take a look at the image of the ghosted person (Figure 4) gazing at the bright “mystery light” in the dawn sky as seen from the Marfa viewing center: that light is a waning crescent moon, blurred by the motion of the Earth during a 30-second exposure.

single car speeding northbound on Route 67, its headlights reaching a curious traveler more than 20 miles away, who is waiting at the viewing turnout. The traveler sees a bright dot of white creeping slowly along the horizon. But then the car’s light rays pass through a boundary of cold air lying underneath warm air, with a huge temperature gradient between the two.

I wondered: how does that change what the person sees? Because light will bend into the denser air, and because the temperature gradient is large, the light disappears for the tourist as the rays angle toward the road surface. But then the car—moving at a clip of around 70 or 80 mph—sends its headlight beams out of the boundary layer and the light reappears to the now wide-eyed traveler. He has just witnessed the most basic incarnation of the Mystery Lights.

In general, however, far more complex geometry governs the machinations of the Mystery Lights. I didn't take into consideration the curvature of the Earth, and my example asserts that juncture through which the light rays passed stood between two layers of uniform air, with no subtle gradations in density. Though my equations were sufficient for solving the basic light-show, I needed to delve more into the science of the atmosphere to explain the dazzling and ever-changing orbs that keep people believing in the phenomenon. But before I could definitively identify which specific atmospheric mechanisms transform ordinary car headlights into supposedly extraterrestrial beings, I needed to step back and take a look at the region itself, the lay of the land of the Marfa Mystery Lights, and the sky above in order

to see what regional-specific factors render the situation unique.

The area lies in the heart of the Chihuahuan Desert, on a high plain not quite 5,000 feet in elevation. Summers here cook up warm, sometimes hot days, with average daily July highs reaching the upper 80s; rarely do temperatures break the 100°F mark, but they can. Average winter daily lows hover in the upper 20s, but they can drop into the teens and single digits. This is important because one of the most important weather factors influencing the Marfa Lights relates to temperature—not extremes or average highs or lows, but the average diurnal temperature variation—how far the temperature swings back and forth over the course of a day. In the Marfa region, that swing surpasses 30°F on average, meaning vertically adjacent layers of air can form with strong, sometimes extreme temperature gradients, creating wide angles of refraction.

Studying the geography of the area yielded more clues to the headlights-atmosphere interaction puzzle. Most everyone who reports seeing the lights spies them hovering above Mitchell Flat, a virtually featureless swath of the Marfa region. Standing at the observation point, visitors can gaze for nearly 10 miles to the southwest toward Chinati Peak and

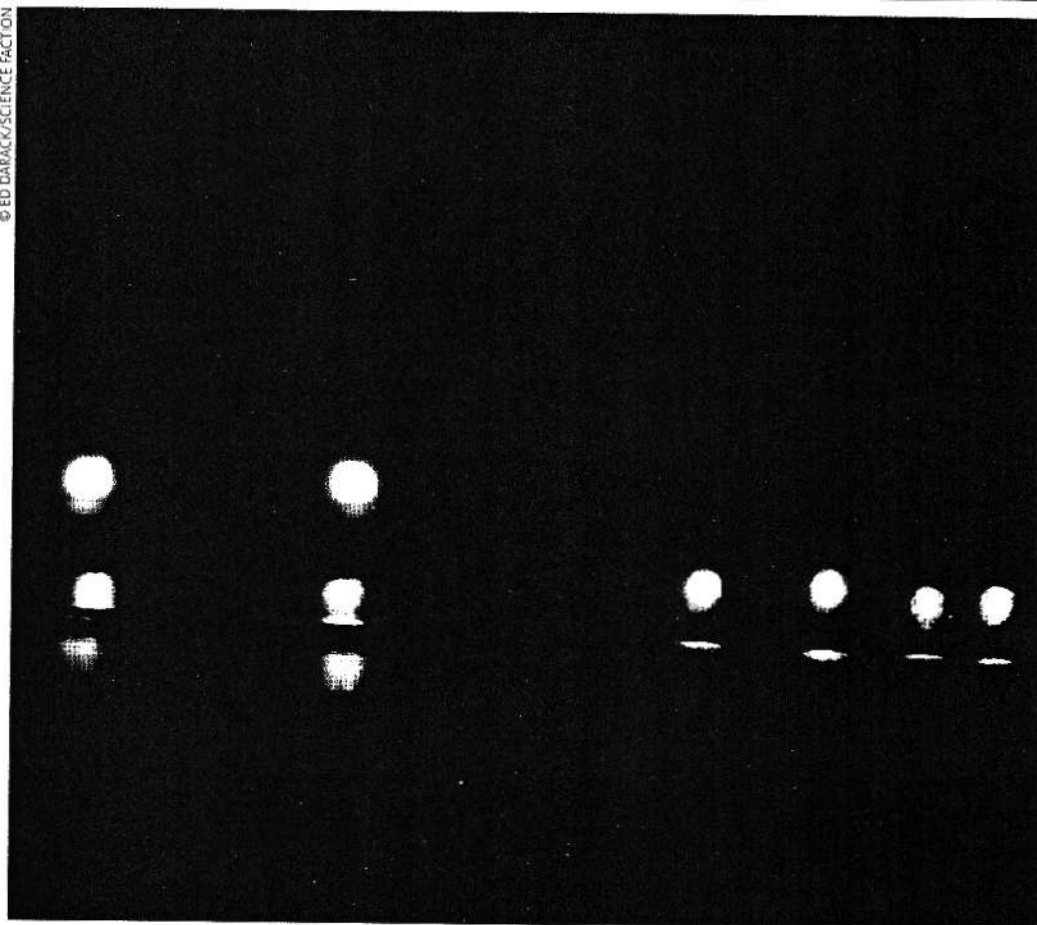


Figure 5: These Marfa Lights are car headlights whose emitted beams are strongly refracted on an inferior mirage. You can see how strongly the refraction makes the lights distort and look otherworldly.

see nothing but a high plain. Mitchell Flat isn't absolutely devoid of vertical features, but it is close, with gentle depressions and rises of no more than 200 feet over the course of miles in most places, creating shallow bowls into which cold air sinks and creates inversion layers. Sometimes layers of air of varying temperatures and densities stack atop each other throughout Mitchell Flat, ready to alter the course of light passing through them.

With more pieces of the puzzle snapping into place, I discovered yet another small bit to the mystery: the high point of Route 67, which vehicles crest when driving toward Marfa, lies about 25 miles to the southwest of the viewing point. The topography to the north of the high point, up to the Marfa area and observation point, is unrelentingly flat, but I found it to be flat to the south of it too.

One should, I figured, be able to first catch a glimpse of headlights of vehicles once they crested the high point, and then watch the lights as they traversed Mitchell Flat. Without any strong refraction, 25 miles is a lot of atmosphere to traverse, and even mild temperature gradients should cause some shimmering and visual aberration. But as I learned more about refraction, I wondered if somehow light could be refracted from car headlights to the south

## Fata Morgana Makes A Trip to New Mexico

The fata morgana can also be spied in White Sands, New Mexico. In Figure 6 there are a number of fine examples of superior mirages, including a fata morgana and a multiple superior mirage. The fata morgana is in the narrow horizontal band.

In Figure 7 you can see how, unlike the inferior mirages, the image is seen above and is reflected multiple times, thus a fata morgana. After these lights from a prison 50 miles away pass through a strong inversion layer, they seem to appear to float much higher and become much larger than they are

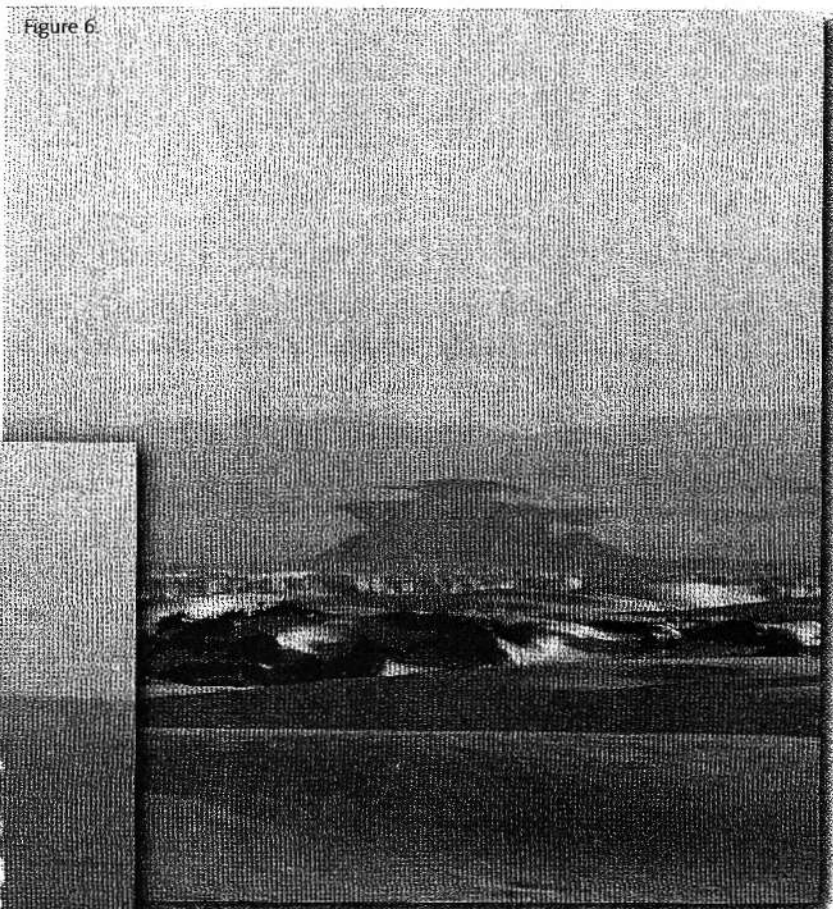


Figure 6.

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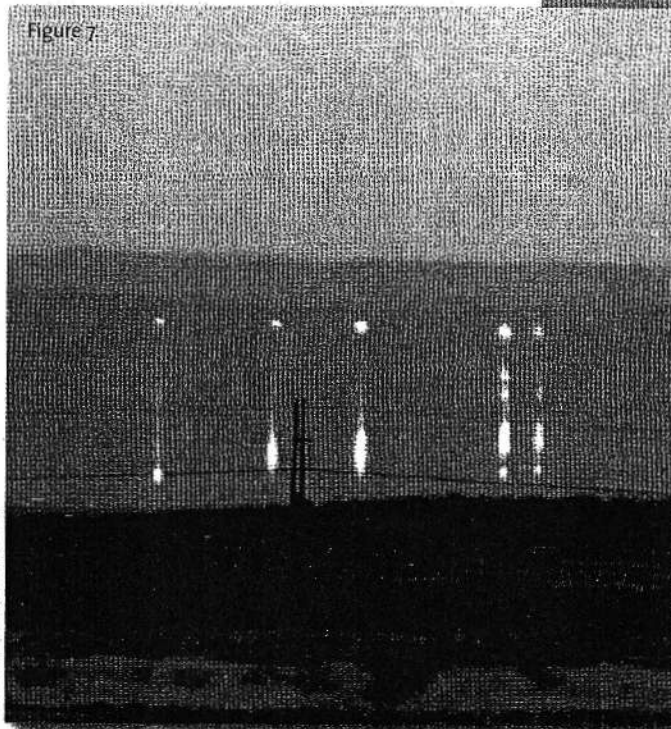


Figure 7.

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in reality. I captured lights “lensed” through a superior mirage, making them appear higher in the sky than they really are. These are extremely rare photographs because they show the phenomenon so clearly. Here you can see lights, which are actually below the horizon, as seen through the “lens” of a fata morgana mirage.

of the high point and bend toward visitors at the viewing area. The answer was a surprising yes, but only in areas with layers of air of sufficiently high temperature gradients—like Mitchell Flat.

### MIRAGES: THE BASICS

Once I grasped the concept of atmospheric refraction, I was ready to jump into the world of mirages. While I, like many people, could identify a mirage and its seeming illusory effects, I was unsure about the genesis of the phenomenon. Even the word itself struck me as somewhat exotic, a bit difficult to interpret. *Mirage* derives from both the Latin word *mirari*, meaning “to admire with wonder,” and the French word *se mirer*, “to be reflected.” Well, the Marfa Mystery

lights have certainly been admired with wonder by many, but those amazed by the lights see them not from reflection, as might be inferred by the name *mirage*, but through refraction. I searched long and hard to find a definitive source that would reveal just how refraction creates a mirage, and more importantly, to learn what refractive process—or group of processes—turn headlights into Mystery Lights. I found that source in Andrew T. Young, an astronomer and expert on atmospheric-optical physics at San Diego State University. His Web site is by far the best source I’ve found for explaining all things relating to atmospheric refraction, including complex mirages, and can be found at <http://mintaka.sdsu.edu/GF/mirages/mirintro.html>. Thanks to Young’s instruction and collaboration, I realized

that a number of phenomena can be at the root of the mystery of the Marfa Lights, from simple refraction to a variety of mirages, to mirage-related phenomena I never before knew existed.

When I first saw the lights, I imagined the cause to be what I thought of as the classic mirage, or the "water on the highway" mirage with which almost everyone is familiar. Called an inferior mirage, because the object seen in the mirage lies below the actual object, this can cause a mysterious effect. With an inferior mirage, light passes through the juncture of cold air above warm air and bends upward. During the day, particularly in desert regions during the summer, these mirages are common as heat from the Sun creates a very hot layer of air near the surface of the Earth. This creates a density gradient in the lowest few feet, with density increasing upward. Rays of light from the sky near the horizon are bent slightly upward, so a viewer staring at a road ahead of him sees the sky instead of blacktop. As convectional heat rising off the pavement churns the air, the temperature gradient continuously changes and the angle that light bends changes constantly, giving the appearance of shimmering water.

But what about Marfa? Could an inferior mirage add mystery to headlights of a car racing across Mitchell Flat? Yes. Even in winter? Yes again. Consider a clear January day; the blacktop of Route 67 warms as it absorbs the energy of the Sun. At sunset, the surrounding dry, desert air cools quickly, but the blacktop remains warm, as does a thin layer of air above it. A car descends from the road's high point, and the viewer sees the distant headlights as the car approaches. Then the light from the car's headlights passes through this refractive layer and the rays angle upward, maybe to a degree "above" the viewer's eyes, making them "disappear," or perhaps the warm pavement continues to cause a strong level of convection, making the lights shimmer as they rise and fall. A car might come from behind the first one, and the single light the visitor sees appears to break into two, then the second car completes the pass, and the viewer imagines an alien craft re-merging along its glowing, shimmering path on a voyage from Mars.

But the inferior mirage represents just the tip of the iceberg. Young said that the *superior* mirage causes an inverted image of the object to appear above the erect one, because warm air overlies cold (an inversion layer), then bends light down. The actual mechanisms of the superior mirage can be far more complicated than simple downward refraction; Young explained a "duct" in which refracted light rays cross one another at intervals governed by the thermal gradient of the inversion, where a viewer will see either an erect or inverted form of the miraged object. This is where the geometry of

the Earth's surface, including topographical features as well as its curvature, comes into play, as objects over the horizon—or on the other side of Route 67's high point relative to someone standing at the Marfa Lights observation point, can be seen in the sky. A more distorted iteration of the superior mirage, the *fata morgana* (Italian name for Morgan le Fay, who was an Arthurian fairy who could change her shape), where the light rays from an object continue to criss-cross each other within the duct, but in ever more contorted ways with distance, could explain the wildest of the Marfa Lights. With a *fata morgana* (a phenomenon that Australian researchers have attributed to their homeland's version of the Marfa Lights, the *Min Min Lights*), distant lights can elongate, separate, rise, fall, and otherwise resemble alien craft.

## BELIEVERS REMAIN

There are other types of refraction forms that I think could be possible culprits in tricking would-be and willing extraterrestrial abductees to drive to Marfa to see the lights, such as the *mock mirage*, where a viewer sees a mirage from above an inversion layer, or the refractive (but non-mirage) effect of *looming*, where headlights far beyond the horizon rise into the sky; or *towering*, another non-mirage phenomenon, where distant car headlights "stretch" into the sky.

But as I pressed the final pieces of the puzzle together—thanks to Young—I realized that doubters and skeptics of scientific logic, and believers in the fantastic, will forever vociferously proclaim their dissent. So with the atmospheric facts behind the lights of Marfa in mind, should prospective visitors make alternate vacation plans? Perhaps to Roswell, New Mexico, instead? *Definitely not.* I found this part of the country to be starkly beautiful; worth a visit for its immense vistas, stark desert, and endless solitude—not to mention the wily lights, visible throughout the year. The town even holds a Marfa Lights convention each year around Labor Day, and I'm sure that everyone who goes there has his or her own ideas about the lights as well as their own reasons for venturing to Marfa (even glitterati are enamored by the lights—during the filming of the movie *Giant*, James Dean would watch them at night through his telescope).

Although the scientific case against extraterrestrial happenings in Marfa, Texas, is pretty strong, it would be a kick if there really were aliens out there, and they just happened to crash-land somewhere out in Mitchell Flat because they confused car headlights with what they thought were Earth-based navigational aids. **W**

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