Katie Paterson
White Light in Dark Matter

by Sylvia Hardy & Chelsey Morell Denny
Field Notes examines central issues in work by contemporary artists by engaging with experts in a range of fields outside of the arts. For this issue, Conveyor editors Chelsey Morell Denny and Sylvia Hardy spoke with astrophysicist Risa Wechsler about the mysteries of dark matter and artist Katie Paterson about her installations and obsessions with cosmic darkness.

History of Darkness, Katie Paterson, 2010 - Ongoing.
Eighty years ago, a scientific finding revealed that our surroundings were off-kilter from what we assumed. Astrophysicist Fritz Zwicky calculated that the gravitational pull of visible, luminous mass did not add up. Something critical was missing. Zwicky inferred that an "invisible matter" or "dark matter" must be present with a much greater density than luminous matter. There are subjects that have a habit of evading our grasp. With origins in science, or metaphysics, or poetry, they are beyond our physical reach or vision or both. Dark matter, which along with dark energy makes up a majority of the universe, poses this difficulty in the extreme case.

But there’s a strange thing about darkness—once you realize you are in it, you often try that much harder to see what’s there. Katie Paterson defines her work by this aspiration to make the invisible visible, the intangible tangible, and the darkness illuminated. The results are fragile and yet resilient, highly researched yet personalized, and materially present, in both physical and intellectual realms. Paterson creates deceptively spare and elegant installations—she is a collector and a careful fabricator—and with her latest project Campo del Cielo, Field of the Sky she also plans on giving back to the vast universe that has inspired so many of her creations.

In conversations with Katie Paterson and Stanford astrophysicist Lisa Wechsler, attempts at tracing the invisible can be by turns overwhelming and reassuring. Through each of their research practices, we are offered glimpses of the vexing and yet stirringly rewarding enterprise of shedding light on dark matter.

Scientifically, one can theoretically measure this dark matter through gravitational lensing, an observation that hints at the presence of the dense and elusive matter through the distortion of the light emitted by galaxies hidden behind it. This is not too unlike the relationship between photographs and their subjects or between a mold used in casting and its object of reference. In these contexts, the traceable original, since it is not directly accessible, is determined through inference, displacement, and some measure of abstraction.

Paterson’s History of Darkness, which she began in 2010, is a growing archive that now contains over sixty-five hundred slides, each one a dark rectangle annotated by the artist by hand and arranged by its distance in light years from Earth. Each slide appears to show nothing but darkness, though it may actually be bursting at the seams with cosmic material transmitted from millions or even billions of years ago. Each patch of sky is meticulously noted and its distance and darkness confirmed. Though the images may harbor an ambiguity of content, it is important to reiterate that there is nothing empty or unspecific about the darkness here. Paterson says she enjoys that the darkness allows viewers’ minds to wander since it allows her to imagine what could be filling their heads as they take them in. But until the specifics about dark matter are widely known, artists and scientists like Paterson and Wechsler love finding new ways to make the darkness a little more familiar.

Part of the power in History of Darkness rests in its accessibility and performative qualities. These slides are not Rymanesque abstractions that merely call attention to their supports; nor are they the cynical stand-ins of Allan McCollum’s Surrogate Paintings. They are sincere documents of, and abstract meditations on, the matter in which they—and we—are suspended, and, like slides of more terrestrial subjects, they can be handled and projected, which allows for an intimacy and interactivity important to this often-impenetrable discussion.

Paterson presents History of Darkness in various ways: Sometimes the cases of slides are opened and available for viewers to sort through—to touch, to read her handwritten notations, to smudge the pencil in which they are inscribed, to hold up to the light—though, she admitted, it can be a pain to reorganize them. Sometimes the cases are closed or individual slides are displayed under glass. One of her favorite productions of the piece was a slideshow performance at the Whistable Biennale near Canterbury in 2010. It was the last performance of the Biennale, staged inside a room with blacked-out windows filled with the whirring of a projector fan. As light streamed from the projector, each slide, starting with the closest one, was announced by its annotation: “1,003,262 light years from Earth…” This went on to the next one and the next, lasting into the morning. As Paterson recognized, “The performance became quite an endurance as we read through the night in the dark room, looking at darkness.” It must have been a bit desta-

Katie Paterson, History of Darkness, 2010 - Ongoing, Courtesy of the Artist
bilizing, but then, after the last slide was shown, “we ripped all of the paper off the windows, and the light streamed through, and we were able to confirm that yes it was all still out there.” The world was still held in place by the dark matter that had been mesmerizing them for the last twelve hours or so.

Wechsler, along with a team of other astrophysicists and programmers, also spends much of her time finding ways to visualize dark matter, most recently in a series of 3-D movies made from endlessly complex algorithmic models of the universe. These movies reorient our notions of deep space, lifting its cloak of invisibility and replacing it with a web-like roadmap to the origins of time and space, going back 13.7 billion years. These models are forensic and predictive in nature, built from endless hours—one would imagine it to be not entirely dissimilar from those spent in the dark room at Whitstable—of studying the sky and its surprisingly crowded visual void. As we learned, researchers of dark matter must quickly become comfortable looking into a cosmos that is largely dark and cold in order to expand our knowledge about the universe. Paterson intends to continue her History of Darkness archive for the rest of her life, getting to know new darknesses with each slide and expanding her collection along with nature’s own expansion.

Both Wechsler’s and Paterson’s methods depend on materiality and confirmation but are equally guided by an awe-struck excitement about the infinite. Paterson’s Campo del Cielo, Field of the Sky, a recast version of a meteorite found buried in Argentina, certainly speaks to both sides of that conversation. Locating just the right meteorite took some searching. “We chose Campo del Cielo,” which is the name of the meteorite as well as the piece, “partly because it had such an amazing meteoric shape, but also because it’s one of the most common meteorite forms and mixtures of metals.” She didn’t want this find to be too rare or imposing. She wanted it to be a fairly common representative of the space junk that it is, in order for it to have a chance to fit comfortably into its earthly surroundings. She worked with a foundry to replicate the meteorite down to the tiniest detail and exact composition. So, effectively, it is the same object, though “obviously it’s not,” says Paterson. It is “still
this ancient thing,” only now it is infused with new intentions. “A new life begins in the reforming, and then it gets returned to the universe.” This last detail is a crucial part of the overall piece. Even though it weighs in at 120 kilograms (roughly 265 pounds), she plans to return it by spacecraft to its place among the stars, where it spent its first 4.5 billion years. Though, she likes to think, too, about whether it might even burn through the atmosphere again someday and return to Earth.

Though she shows in plenty of traditional galleries, Paterson is also obviously fond of working against predictable settings for her art. Wechsler first encountered her work on the walls of an astrophysics lab while she was visiting colleagues at the University College of London, where Paterson had been an artist in residence. Campo del Cielo has also appeared on the streets of London during the 2012 Olympics, “by a tree next to the Royal Geographic Society,” attesting again to the importance placed on accessibility. Once it is returned to space, this accessibility vanishes, of course. But, having known the object here on Earth, perhaps it will be easier to follow it, now that it is grounded in our own material experience, on its journey home.

Wechsler and others at Stanford and at the Kavli Institute for Particle Astrophysics and Cosmology also strive for this level of accessibility without sacrificing accuracy in their theories. One major issue is scale. In one of the 3-D movies, 13.7 billion years—starting roughly four hundred thousand years after the Big Bang—were condensed into a clip of about thirty seconds. It is important in these films that the pacing and visual relationships, though they are shrunk to a manageable size, remain true to the actual time-scale relationships.

Paterson has also commented on several projects on these relationships to time, drawing it out enough to make cosmic scale a palpable manifestation. In As the World Turns, a record of Vivaldi’s Four Seasons makes one full revolution every twenty-four hours instead of at its typical RPM. At this rate, it would take four years to play from beginning to end. Played at normal speed, the music is digestible, recognizable, and culturally distinct, but at this slow speed the listener hears virtually no sound beyond a nearly imperceptible hum. The only confirmation that the record is moving at all is a visual one, found in the impossibly slow shift of the label, noticeable only after several hours. Paterson recognizes that this level of time abstraction may be very disappointing to people, particularly since they are invited to listen with the provided headphones. However, just as the dark slides in History of Darkness were not depicting a total absence of matter, this silence is not an empty silence. The expansion of Vivaldi to this indiscernible scale opens up a space for meditation on our own position in the universe. It also brings to mind the famous Debussy quote about the true music existing between the notes. This installation certainly stretches that theory to its breaking point.

Debussy’s sentiment is embraced by many experimental musicians as well as other conceptual artists like Katarzyna Krakowiak. In her installation Making the Walls Quake as if They Were Dilating With the Secret Knowledge of Great Powers for the Polish Pavilion in this year’s Architecture Biennale in Venice, Krakowiak interprets architectural space by having us listen intently to its sonic vibrations. This visceral practice leads us to wonder about what whispered secrets would exist in the architecture of space were it possible to hear them.

Wechsler spends most of her time thinking about light and its interactions with celestial matter, but she spoke briefly about the scale the sound waves from the birth of the universe might have. By now, she said, these vibrations from 13.7 billion years ago would have grown to hundreds of thousands of times the size of an entire galaxy. Calculations on this scale boggle the mind, and, while As the World Turns is not a direct illustration of this level of cosmic scale, is it even possible to imagine Vivaldi extended to the life of the universe or even to one paltry light year?

Paterson’s conceptual rigor and familiar materials allow us to easily tap into this sort of thought experiment about the limits of reason and the universe. In the midst of these vast invisible forces and theoretical algorithms, Wechsler feels it is vital to return to an observational mode, so she collaborates with several sky mapping projects. One of these is the Dark Energy Survey, which aims in the next five years to capture one-eighth of the sky, more than has ever been documented before. In order to reach this far into space, the

Dark Energy Survey uses the range and precision of a specially calibrated 560-megapixel camera, the largest of its kind.

Even though the highly rational field of astrophysics depends on these visual markers to make physical sense of the world, in order to truly understand the invisible some balance must be struck between these material confirmations and the bigger mysteries present in the unknown. While we may be able to track *Campo del Cielo* as it journeys around space, do we have to know its exact location in order to feel a connection with its position in the cosmos?

As Sean Carroll, who has been successful popularizing scientific inquiry on the subatomic end of the scale spectrum, drives home in his recent book *The Particle at the End of the Universe*, “Passion for science derives from an aesthetic sensibility... We discover something new about the world, and that lets us better appreciate its beauty.” Paterson might argue that it works the other way as well. In her work, we find not only an appealing and comforting aesthetic, but a motivation to understand the darker metaphysical questions as well: Who are we in relation to the universe, and why did we land here?