"This Show Is So Metal": The Curators of *Lumen: The Art and Science of Light* in Conversation

Kristen Collins, Glenn Phillips, and Nancy K. Turner

Although contemporary society separates science and spirituality, in the medieval world the science of light was harnessed by artists and theoreticians to better perceive and understand the sacred. Focusing on the intersection of arts and science in Western European art, this major exhibition, which took place at the Getty Museum from 10 September to 8 December 2024 as part of PST ART: Art and Science Collide, demonstrated how the study of light, vision, and the movement of heavenly bodies was explored by Christian, Jewish, and Muslim scholars and theologians during the "Long Middle Ages" (about 800–1600 CE). With glimmering golden reliquaries, illuminated manuscripts, rock-crystal vessels, early scientific instruments, and other objects, the exhibition showcased how the ancient sciences of optics, geometry, and astronomy fed the poetry and artistry of this period (fig. 1). To convey the sense of wonder created by moving light on precious materials, and to explore ongoing fascinations with vision and perception as well as humankind's place in the cosmos, contemporary artworks were placed in dialogue with premodern artworks. Here, the three curators of *Lumen: The Art and Science of Light* discuss their collaboration, which brought together the worlds of science and religion and bridged the fields of medieval and contemporary art.

—Kristen Collins, Nancy K. Turner, and Glenn Phillips

The conversation below took place in person in November 2024 at the Getty Center in Los Angeles. It has been condensed and edited for length, repetition, and clarity. Italics and underline have been added to capture words or phrases emphasized in the original dialogue.

Kristen Collins: Should I start? Some projects are ones that you start right out of the gate and dive right into. This one was actually a concept that Nancy Turner and I had put a pin in for quite a number of years. We had talked about doing a relatively small exhibition on light in the Manuscripts gallery accompanied by a contemporary installation in a second gallery in the North Pavilion. This was following experiences that we had many years ago in the Sinai desert, when we were planning the exhibition *Holy Image, Hallowed Ground: Icons from Sinai* at the J. Paul Getty Museum in 2006–7.[1]

Getty Research Journal, no. 21 (2026): 185–222 © J. Paul Getty Trust

FIG. 1. — Installation view of the exhibition *Lumen: The Art and Science of Light,* Los Angeles, J. Paul Getty Museum, 10 September–8 December 2024, with the Vatican Sakkos (left) and Munich Choros (center). Sakkos: Constantinople or Thessaloniki, Byzantium, 14th century, blue silk with silver, silver gilt, and colored silk threads, 162 × 144 cm, Vatican City, Fabbrica di San Pietro, CSPV inv. 0107; and Choros: Byzantium, 13th or 14th century, cast copper alloy, h: 576 cm, diam.: 340 cm, Munich Archäologische Staatssammlung, inv. 2003_8660. Photograph © J. Paul Getty Trust, 2024.

Over the course of researching that project, we attended Easter and many other liturgies at the Monastery of Saint Catherine at Mount Sinai, Egypt (fig. 2). There, we witnessed the effects of moving light in a sixth-century Byzantine church. We noticed the way that it moved the visitor to states of emotion and religiosity, and we wondered if we could import some of that into the museum environment.

The germ of an idea for a Manuscripts [Department] one-gallery show was a corrective view of light in medieval spaces, and on medieval objects. Our manuscripts are inherently haptic objects. They were meant to be handled; their pages were meant to glitter in the light. And yet, when we have them on display, they're like butterflies pinned inside a collector's case. So that begged the question: How do we convey some of the activation that happens when you're carrying objects through church spaces or mosques? Or when you're opening books, or looking at light glittering on mosaic and gilded domes?

For our thought to have one contemporary art installation across the way, one artist whom I just loved so much, Ann Veronica Janssens, started the wheels turning on how a contemporary installation could channel the medieval world. She creates projections of

FIG. 2. — Easter Liturgy at the Holy Monastery of Saint Catherine, Sinai, Egypt. Photograph by Robert S. Nelson, 2005.

light on mist. And one of the things that had so captured me at Sinai was the projection of sunlight and candlelight on clouds of incense hanging in the air.

Nancy Turner: In a parallel fashion, I got interested in the history of optics—the subject of the exhibition's eventual second section, "Light and Vision"—because of the work I'd done on the use of metals in manuscripts, on their pages. Originally it was just to answer the basic questions: Is it gold leaf? Is it painted gold? And I had done a small

FIG. 3. — Installation view of the exhibition *Lumen: The Art and Science of Light* with *Tapestry of the Astrolabes*, probably Tournai, Flanders (Belgium), ca. 1400–1450, wool and silk, 415 × 800 cm. Toledo, Spain, Cabildo Catedral de Toledo, Primada de España, inv. 04/2312. Photograph © J. Paul Getty Trust, 2024.

survey of a thousand years of manuscript illumination (based on the Getty's collection of illuminated manuscripts), looking at how methods changed over the centuries.[2] The way illuminations engage the eye in different ways really got me intrigued: How were people in the Middle Ages talking about the eye? How were they talking about light? And this led me to the history of medieval optics and some of that scholarship.

KC: And so this idea, which was going to come with the considerable expense of a contemporary installation, sat on the backburner for a while until the PST ART: Art and Science Collide theme was announced.[3] And then it actually sat on the backburner for even a while longer. *[laughter]* We were late to the game—we joined the PST roster in 2021, when we were asked to pitch an exhibition for the Special Exhibitions Gallery. We jumped at the chance, because it seemed like such a great way to expand that initial idea. At that point, we had to turn a concept for a manuscripts show from our own collection into a large special exhibition. Being a part of PST ART really upped the ante as far as needing to engage with medieval science as a discipline. The rubric for that first section of the exhibition is "Astral Light," and it is to Nancy's credit that we jump in with the giant *Tapestry of the Astrolabes* (fig. 3), which she was convinced we could secure if only we could find the curators in charge.

NT: We have to remember, this was all conceived during the pandemic itself, in 2020–21, and we weren't able to start traveling until '22. But some money came up in early '23 and we wanted to pursue the tapestry. We really didn't know whom to contact after I spotted

it in the catalog for *Circa 1492: Art in the Age of Exploration* (1991–92), an exhibition at the National Gallery in Washington, DC, which listed Museo de Santa Cruz in Toledo, Spain, as the lender.

While some asks were made over Zoom, the request for the tapestry was made in person. We can't say enough about meeting with custodians of cultural treasures in person! And it turned out that the piece was no longer in the museum listed in the National Gallery catalog thirty years ago, as it has since moved back to Toledo Cathedral, where it had been since the early sixteenth century. My visit was this classic curatorial scenario when you have only *one* day to make the meeting happen, and you're sitting in the office of the museum director where the piece *isn't,* and having to ascertain where it is now located and how to see it! The director of the Museo de Santa Cruz, Antonio Dávila Serrano, kindly phoned the office of the Patrimonio, the body responsible for the treasures of Toledo Cathedral. Thankfully, María del Prado López from that office at the cathedral answered the phone, and she was able to meet me within the hour. She led me to a museum that the cathedral operates in another part of the city. The *Tapestry of the Astrolabes* is now housed at the cathedral's Tapestries and Textiles Museum [Museo de Tapices y Textiles de la catedral de Toledo], which had been shuttered since the Covid pandemic. She flips on the lights—and there this glorious tapestry was. It was just such a "wow!" moment, from out of the gloom and into the bright light. Ultimately, after a protracted series of e-mails, we were able to bring the tapestry here to Los Angeles. But I think that first meeting, that in-person connection with someone, was absolutely essential, no less during the context of a global pandemic.

KC: Although, one of the formative meetings that first kicked off this show for us in 2021 when we joined PST ART was an online convening, "Intersections 2021," co-organized by the National Academy of Sciences and the Getty Foundation and held on a platform called "ePosterBoards," that brought curators together with scientists. We were able to move through an online reception and drop into a virtual table of neuroscientists who were more than happy to talk about neuroscience and art and the intersections thereof.

NT: It was a really inspiring session for us. And likewise, they were thrilled to meet us too! It was a wonderful and formative, dare I say, *collision* of worlds. It was like speed dating in this sequence of Zoom rooms, where we gave our minute-and-a-half pitch about the *Lumen* show to all these neuroscientists, one after the next.

KC: It turned out to be a very friendly way to workshop ideas for the exhibition, which was really valuable.

NT: And as a result, we developed the third section, "Aura and Performance," that includes the neuroscience of light, both medieval and modern. There's also the complementary convening that Kristen organized at the Getty, "Art, Science, and

Wonder in the Medieval World," the second panel of which focused solely on the neuroscience of light.[4]

KC: It was shortly after that formative time early in the pandemic that we reached out to Glenn to partner with him, because our concept was to include a number of contemporary objects and installations, expanding on the one immersive installation that we had originally envisioned.

Glenn Phillips: So then I came in, I think, probably a year and change after you were really deeply in it.

KC: Yes, a very welcome addition.

NT: Very serendipitous, and you brought amazing things to the show.

GP: I'm going to say actually it's for the best that you had the exhibition sketched out before we could start thinking about adding contemporary art. If we started trying to conceive it together, it maybe would have been different, and not in the best way. Because I had to start by learning the show. You had images of everything, and the catalog was somewhat drafted, and so I could start from a place of "What is the main narrative? What are the main ideas? What are the images that you see recurring?" And to then think where and how a contemporary work might fit—like, what are the moments?

KC: Hearing that fills me with such relief even now, as we've never talked about this! [*group laughter*]

KC: At the time, Nancy and I entered the big project—the PST initiative writ large—very quickly. Then we realized, you know, we need an expert. Some of my contemporary colleagues commented, "Well, you've constructed a show and *now* you want a contemporary curator?" But Glenn coming on board even one year in helped us to really sharpen the messaging and key points around the exhibition. And some things were surprising!

NT: Yeah. And it was an evolution, too. I mean, you didn't have everything all sewn up right away. It took a little bit—it took some time and some conversations, right?

GP: *[simultaneously with Nancy above]* It took some time, yeah.

KC: And, I mean, we flipped the order of the show dramatically a few times while trying to accommodate one piece that we ultimately didn't bring in. That exercise that the three of us went through together with the designers to map out how this piece might fit, which would have radically changed the flow of the show and the way that the story could be told—that was a big takeaway.

NT: Yes, definitely. *[laughter]*

KC: "If you want contemporary, you need to make room for it!" *[laughter]*

GP: With this show and my job in general, I work with a lot of installation artists, and I have, in part through previous PSTs, worked a lot with Light and Space art.[5] And the exact same object succeeds or fails based on everything else around it—how the museum presents it, the amount of space they give it, how they light it, how they allow people to approach it. A lot of that work is just trying to preserve what the artist needs or what's going to make the piece look the best. That comes out during the design phase. Because sometimes you can't nudge the piece, or it needs to be at a specific angle, or take up a certain amount of space—that's true of all artworks, but some works need particularly close attention.

When pieces are not fully self-contained and have an installation element, then the curator is the only person who can really look out for them. The curator has to make sure that the team understands that the space around the piece is also the piece. The artist isn't in those meetings. And you can't show up and change a design. Well, I mean, you could, but it's very hard. It's even harder in a show that's filled with couriered objects.

KC: Absolutely. It was so helpful to have Glenn advise where we shouldn't skimp in certain areas. Because, you know, resources are carefully budgeted, and we're always looking for ways to optimize the funds that we have. For example, the Helen Pashgian installation wouldn't have been so sensorily disorienting and wonderful without you advocating for the space to be painted all white.

GP: You can't (or at least shouldn't) just say "because I said so." The whole team needs to learn and understand the *why* behind some of the visual and construction decisions that might be significantly more costly or labor intensive but that can also make all the difference in the success or failure of a piece. I think everyone was really supportive of this show, but we definitely had to advocate for things like that. Likewise, you were constantly advocating for some rather ambitious loans, let's say. *[group laughter]*

KC: Definitely. Our motto was "More is more." *[laughter]*

NT: More is better! *[laughter]* And we knew we needed big, impactful things. The Special Exhibitions Gallery is a huge space to fill. And we've done other medieval shows of manuscripts where it's all very low to the ground, in object cases at eye level and lower. By contrast, contemporary artworks bring your eyes upward. The chandelier [*Munich Choros*, Byzantium, 13–14th century] of course does this (see fig. 1).[6] The tapestry is also a big *wow* when you first walk in (see fig. 3).

And, you know, it's all working within the constraints of the space. An exhibition gallery that has a corridor in it—it's a little hard to factor in. But that was a moment of kismet,

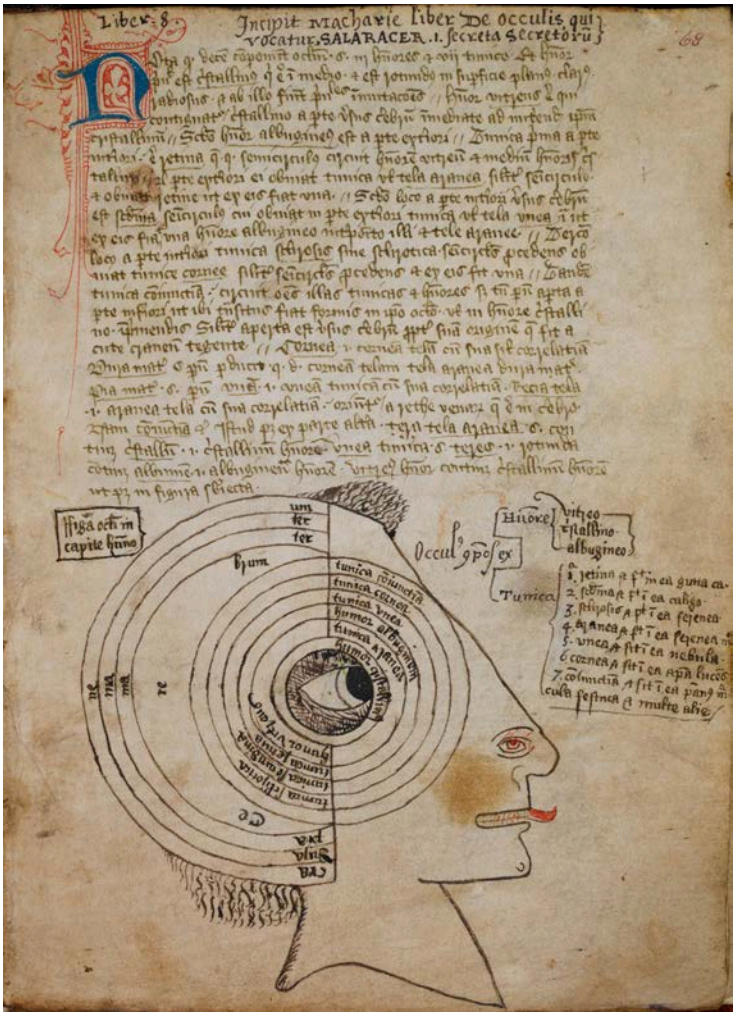

FIG. 4. — ***Diagram of the Seven Tunics and Three Humours of the Eye and the Skull* in *Medical Miscellany*, including the *Book of Macharias on the Eye Called Salaracer, or the Secret of Secrets*, England, 1375–1425, ink on parchment, folio: 23 × 17 cm.** London, British Library, MS Sloane 981, fol. 68. Photograph courtesy the British Library collection.

putting our eyeball diagrams in the space called the "oculus" (figs. 4, 5). *[laughter]* We get great humor out of that. *[more laughter]*

KC: My cousin's six-year-old child pointed out on a tour that the oculus looks like an eye, had I noticed? It was wonderful.

One of the things worth mentioning is that Nancy and I are old school, and so when we laid the show out, we were doing so with Post-its and little pasted pictures of the cases on our gallery plan. And then we took that up to the space to try to figure out where we could fit a giant chandelier. And, you know, initially we had the show flipped—we were going to walk into the big cube first, to open the show. And we were going to close with

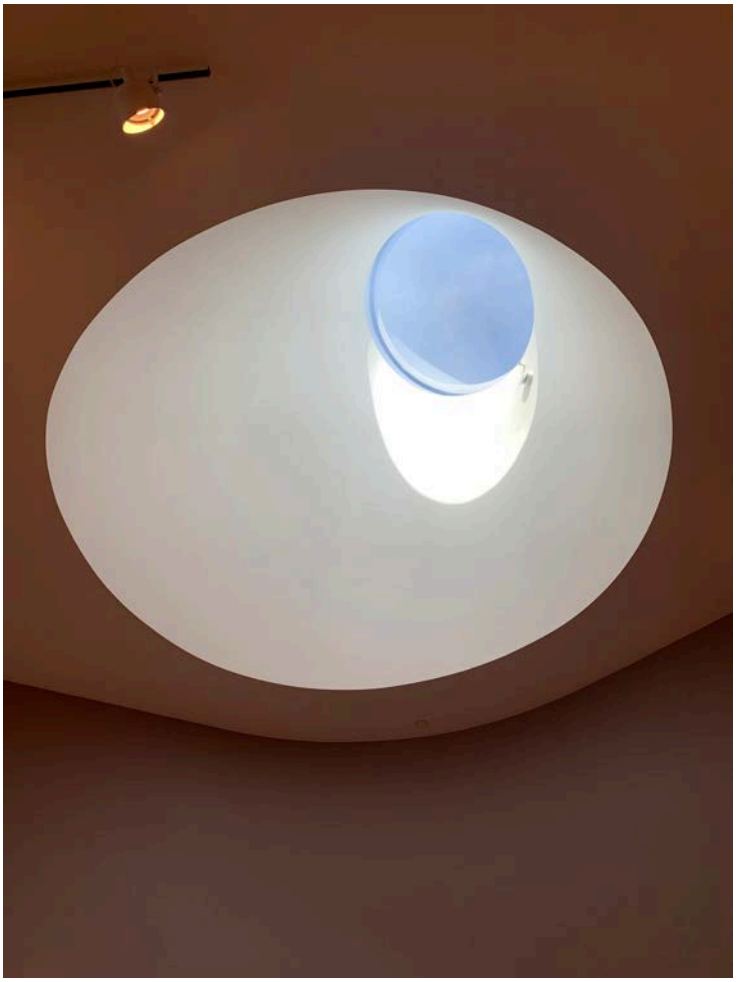

FIG. 5. — View of the oculus in the Special Exhibitions Gallery, Getty Center, Los Angeles. Photograph by Kristen Collins, 2024.

the chandelier in the rectangular gallery. But standing there we realized: *It's not going to fit.*

NT: That gallery isn't high enough. *[laughter]*

KC: The rectangular gallery has a lower ceiling height. The giant chandelier [*Munich Choros*] would not fit without it trailing on the ground. So, there were some very nuts-and-bolts ways that we began laying out the show, shuffling Post-its on a plan while sitting on the gallery floor.

NT: It required a complete 180-degree flip, a wholesale rerouting of the show, which started with astronomy in the "Astral Light" section, followed by "Light and Vision," and concluding with "Aura and Performance." We were making and accommodating the show in that way. That's why one of the installations that Glenn was going to bring in

didn't fit. So he pivoted and found the perfect painting instead—Vija Celmins's *Night Sky #4* (1992; fig. 6).

FIG. 6. — Installation view of the exhibition *Lumen: The Art and Science of Light* with *Night Sky # 4*, 1992, oil and canvas mounted on panel, by Vija Celmins (Latvian American, b. 1938); and geometric textile fragment, Spain or North Africa, 14th–15th century, silk lampas. Los Angeles, The Museum of Contemporary Art, 97.34, Gift of Lannan Foundation, art © Vija Celmins; and New York, Metropolitan Museum of Art, Fletcher Fund, 1946, 46.156.16. Photograph © J. Paul Getty Trust, 2024.

GP: We had gotten very far on plans for an Otto Piene Light Ballet installation (fig. 7). It was one that includes a false wall covered in little holes. The space behind the wall is illuminated, so those holes turn into tiny points of light that are in a pattern very reminiscent of the medieval nested spheres of the universe. And then a series of kinetic sculptures in the room cast changing, spinning points of light across the space, with different elements of the installation activating at different times. If you look at the whole first gallery, almost every single piece is circular. Whether circular astrolabes, depictions of the heavens, or early mapping of the sky, everything is taking the same form. And so I loved the idea, with the Piene, that you would walk into this spinning galaxy and see the repetition of these forms that you're seeing everywhere else in the gallery. But it *was not* meant to be. *[group laughter]* I think we tortured the designers in ten different ways trying to get this to fit, and they *really* tried everything—

GP: They tried things I had never seen before in that space, but it just couldn't happen.

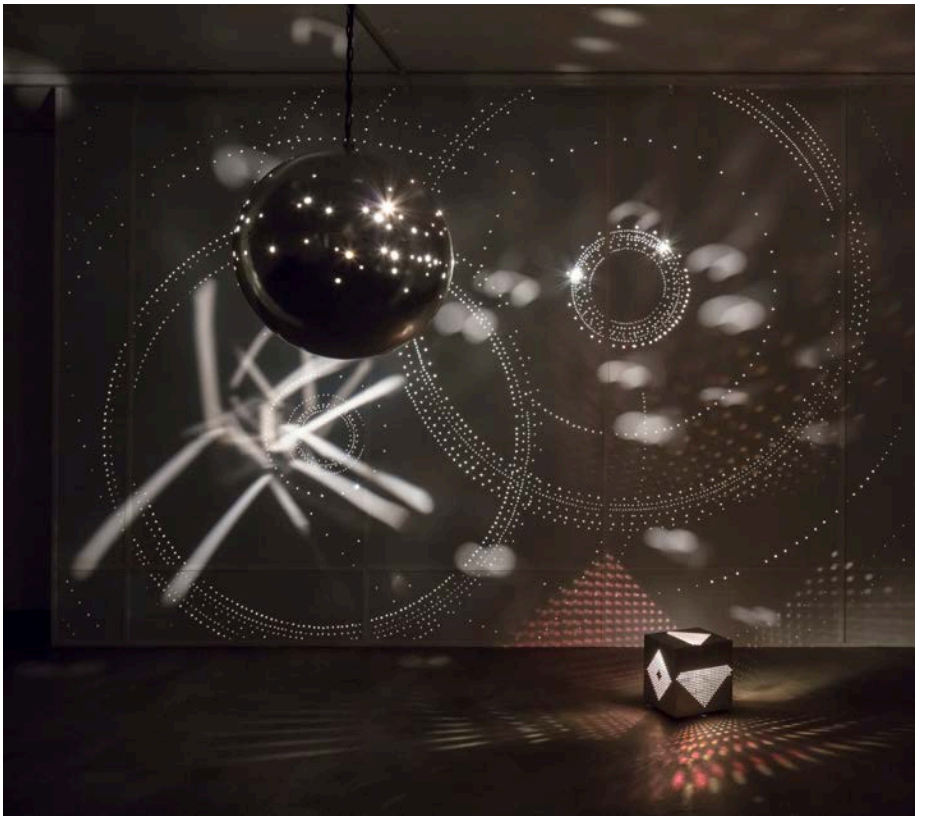

FIG. 7. — Otto Piene (German, 1928–2014). *Lightroom with Mönchengladbach Wall,* 1963–2013, cardboard, wood, metal, motor, light. Art © Otto Piene Estate / VG Bild-Kunst, Bonn. Digital image courtesy Sprüth Magers / Photograph: Timo Ohler.

KC: We even made a short-lived bid for the [museum] bookstore space that didn't pan out.

GP: In the end, though, we replaced that giant installation with the Vija Celmins painting—right before our catalog was about to be locked down. We negotiated that loan in forty-eight hours, and then I wrote the catalog text in twenty-four hours. We just told Publications, this thing has happened and, you know, in the hopes of you agreeing, we've taken the liberty of writing a new text.

So that happened within days. But I think Celmins's painting is so perfect in the space; I don't know that we would've needed a spinning galaxy, really, when what you're walking into is already so impressive. And the show has this nice crescendo now. That first little moment with the Celmins, it's like a little jewel. It's very quiet. Maybe not even everybody notices it. But it's a powerful moment in the show (see fig. 6).

I guess my revelation is that I began by looking at all this stuff as being so distant. It's so long ago; it doesn't look like art now. I don't understand what an astrolabe does, and I never will. [*group laughter*]

You know—the celestial maps don't match the way I think of the heavens. And then I realized that the Vija Celmins sky paintings are of star maps—actual star maps made by machines that we send into outer space so that we can see farther than we've ever seen. Because we have never stopped mapping the stars. This is one of humanity's continuous endeavors, and it's still happening very actively right now. That's a point of connection that someone might experience. Star mapping is not so distant; it's just that we do it with different machines now. And we still have people copying maps. You know, Celmins, she compares herself to a scribe.

Piene's works are based on his having to stare at the night sky for hours at a time when he was a gun operator during World War II. So there was a morphological connection there, but not as poetic in the long run. So sometimes things happen that actually benefit the show, even though it feels like something's gone wrong.

KC: Our constellations of objects took on power that we didn't expect. The painting by Celmins, who calls herself a scribe, is on view just steps away from the Hildegard of Bingen *Book of Divine Works* (*Liber divinorum operum*, Germany, ca. 1210–40). And, you know, there is a little image of Hildegard [in the lower-left corner of the manuscript page] recording her vision of the *Lux Vivens* (the living light of God).[7] But all of her visions are cast in cosmological imagery. She sees herself or humankind as a microcosm of the larger macrocosm that is the universe.

So you have something like that just steps from the Celmins, and then steps away from there is a silk textile fragment that is very similar to the Celmins in its dimensions (see fig. 6). The textile fragment, from either North Africa or Iberia [fourteenth century], has a geometric pattern on it.[8] We talk in the exhibition about how light traveled in lines and rays, and how geometry was used as an expression of light. This textile was embroidered with repeating star patterns, to some extent representing the infinitude of the universe. So, all of these things, you find them gelling in ways that, yes, you planned for. But then when you do two tours a day for three months, you find which stories are the most powerful. And I think that cluster is really powerful—it's a little constellation.

NT: So, we're delighted that there's poetry in a show that's rooted in math and science, right?! *[laughter]* Just to stand up for the astrolabes—we're manuscripts people, and we work with books that are themselves instruments with spinning discs called "volvelles." And we just got super into these astrolabes, while we freely admit that we cannot fully understand them! *[laughter]* We had a tutorial from Taha Yasin Arslan, an artist-scientist-maker who creates facsimiles of astrolabes; two of them are included in *Wonders of Creation Art, Science, and Innovation in the Islamic World*, another PST ART exhibition at the San Diego Museum of Art, and have since been accessioned into that collection.[9] But we just felt so strongly that to start with actual astrolabes was a way to bring people right away into the medieval scientific world that was so cross-cultural,

interdisciplinary, trans-religious. We have astrolabes that are inscribed in Hebrew, Arabic, Persian, and Latin (fig. 8).

FIG. 8. — Installation view of the first section of the exhibition *Lumen: The Art and Science of Light*, "Astral Light," with astronomical instruments and manuscripts. Oxford, England, Oxford History of Science Museum. Photograph © J. Paul Getty Trust, 2024.

KC: Yes, we make the point in our tours that science was the common language of the Middle Ages. We say that though people may not have been reading the same things all at the same time, they were drawing upon a common corpus of ancient Greek scholarship that was then translated, questioned, improved upon, and added to over the course of the long Middle Ages.

NT: We really did pursue the brief of PST ART to bring the art and the science together. I think the first room of the exhibition, the "Astral Light" section, does that in an impactful way.

KC: Nancy and I have always recognized our limitations as scholars of the Latin West. We do not read Arabic; we are not Islamicists. Happily, we know Islamicists, and so early on we reached out to a group of people who would form our scientific committee, and whom we could bring into the project. This has become much more common. I think that many people include a line item for scientific committees in their grant proposals. It's not something that the Getty Museum has done before to my knowledge, and so we're very grateful that the Exhibitions Department was able to fund this. We had at

least a dozen people on our scientific committee at various times, but it kicked off with a series of online convenings. I think we had about three or four meetings—

NT: On Zoom, in the fall of 2022.

KC: It was quite close to our deadline, I would say, *[laughter]* because then we tapped many of those people to be authors for the catalog—

NT: which was due like six months later! So this whole ambitious project has been in high gear from day one, really, because we were told by our administration to go big *[laughter]*. More typically, curatorial teams have about six years to work on these things—

KC: If not longer!

NT: And we basically had less than half that time.

KC: I'd like to go on record as a proponent for percolation time. Three years was a very tight turnaround.

NT: And to really dive into the literature—especially the scientific literature on optics and astronomy—was really a big lift.

KC: I mean, the evolution of the object list shaped our scholarship as well. The idea of being able to have the monumental *Tapestry of the Astrolabes* on view alongside some of the greatest objects from the Oxford History of Science Museum's collection of instruments—astrolabes and one quadrant [*Quadrans vetus* Horary Quadrant, possibly France, ca. 1300] (see fig. 8)—very much changed what we were reading and how we were thinking about the exhibition.

NT: The exhibition checklist was constantly iterative. We started with a very positive response from Lucy Blaxland and other colleagues at the Oxford History of Science Museum, and likewise a motivating and generous response from Poul Grinder-Hansen at the National Museum of Denmark for the Ølst Golden Altar (1200–1225). Lisa Woop and her colleagues at the Optical Museum in Jena, Germany, kindly lent us an anatomical model of an eye (fig. 9). So there were just certain things that fell into place fairly early on and then other things that took longer for us to get to.

KC: We were traveling for the show, as Nancy said, and writing long-loan request letters from a speeding train. I remember receiving our second *yes,* for the eyeball [Eye model, France, before 1700] when we were in Florence, after we'd already received a *yes* on the Golden Altar. And Nancy said, "Well, we've got a golden altar and an eyeball. We have a show" (fig. 10). *[group laughter]*

FIG. 9. — Eye model with case, France, before 1700, silver and glass (model), h: 10 cm, diam.: 4 cm; leather with gold tooling (case). Jena, Germany, Stiftung Deutsches Optisches Museum, 873610_0002726, 873610_0002621. Photograph: Luca Spano. Digital image courtesy Stiftung Deutsches Optisches Museum.

FIG. 10. — Installation view of the second section of the exhibition *Lumen: The Art and Science of Light,* "Light and Vision," with the eye model and case, France, before 1700, in proximity to the Ølst Golden Altar, Ølst, Denmark, 1200–1225, fire-gilt copper sheet over oak, 106 × 183 cm. Jena, Germany, Stiftung Deutsches Optisches Museum, 873610_0002726, 873610_0002621; Copenhagen, National Museum of Denmark, inv. D.5144. Photograph © J. Paul Getty Trust, 2024.

GP: I mean, that's pretty much the middle section of the show, "Light and Vision," right? [*laughter*]

NT: Exactly.

KC: Yeah, little did we know that they would ultimately be on display right next to each other, the eyeball staring at the golden altar! *[group laughter]*

GP: I would step back and add a word about advisory committees, because I think that this is one of the pillars of PST ART. The Getty Foundation always awards support to curators to develop an advisory or scientific committee. It's so valuable for scholarship, but small institutions can almost never afford them, and even at larger institutions it's one of the first thing to go when you have to cut expenses.

We've seen over and over again through every version of PST that being able to convene your peers and get the best specialist knowledge improves exhibitions—it brings to light potential loans; it brings catalog authors; and it benefits everybody on that committee and not just the institutional community. Anyone who has gotten one of these grants will say that having an advisory committee changed the course of their show.

NT: Oh, 100%, including this one. During the initial phase, we had a very rough object list that we shared in advance with all of our interlocutors on PowerPoint. Then we met on Zoom with groups of them, and we asked everyone to present objects that they thought would be appropriate too. So they were making suggestions. That was so helpful, to be directed to things we hadn't been aware of. And, likewise, for things that we had hoped to include but had to be dropped for various reasons, many of these works are still represented in the catalog essays because the authors saw our very early PowerPoint.

KC: So at least they're enshrined somehow. As I mentioned before, the Islamicists and the historians of science as well as the Byzantinists and Hebraists working with us have been amazing. They have been our teachers as well as our colleagues; they offered such deep field knowledge that then went into the catalog. Even beyond that, Margaret Gaida, one of our scientific committee historians of science, and Megan McNamee, another member of the committee who works on geometry and diagrams, read all of our labels and commented on them—it was difficult and, in many cases, new-to-us material. As Nancy mentioned, she's worked on optics, but the historians of science brought it to the next level. I don't think either one of us had done much with astronomy since grade school days! *[laughter]*

But as Nancy was describing before, the spatial constraints of the interior architecture of our galleries shaped the exhibition's narrative; we go from astronomy in the first section to optics in the second section, where you can use the geometry of light as well as practical geometry to think about the ways that ancient and medieval people thought about the so-called pyramid of vision and how light enabled sight, whether it was from light entering or exiting the eye. From ancient times geometry was used for land surveying or for the measurement of distances between heavenly bodies.

NT: Part of this project for us, the medievalists speaking, is that we're fundamentally responding and reacting to the Enlightenment thinking that we all have been schooled in, which says that science begins with the Enlightenment thinkers and art begins with the Renaissance in Italy. And we're saying no, science has been going on for thousands of years. Especially the astronomical observations of the movement of the stars as well as Renaissance perspective—these are coming out of a Euclidian tradition that has a nearly eight-hundred-year history by the time [Filippo] Brunelleschi comes along. We pop that bubble of "These are the Dark Ages." This is what has been in the scholarship for decades, but it just hasn't been brought to light in a public forum like an exhibition. So that was one of our major goals for the show.

KC: We still like our stories of individual genius, but, you know, [Nicolaus] Copernicus did not come to this idea of a heliocentric universe in a vacuum. He's using the math that Muslim astronomers in the Islamic sphere—the great observatories of Samarkand, Damascus, Marāgheh, and other places—were using and developing in order to better

understand the movements of heavenly bodies. He's figuring out where the previous mathematical models were falling short and in need of refinement or rejection.

GP: Science is a way of representing and figuring the world around us, so there's a huge visual component to that. And as I've learned more about these objects, I'm seeing that on an astrolabe, you're putting a star map on top of a layer depicting where you are on the planet. And you see that repeated on the *Tapestry of the Astrolabes*. You see the bottom part with the flowers, that's the earth (see fig. 3). And then there's, a little larger, the stars above. But the constellations are on top of them, representing these higher worlds. And then where do you go from there? It eventually gets you to the heavens, or to God.

There's this kind of ladder in our show that gets you from hard science to religion. And so, for me, what's striking as we move into the second section about optics, is that artists are now using the same scientific tropes to represent ideas about God or happenings in the Bible. That ladder that gets you from science to wonder is also, I think, one of the narrative threads of the show, which pushes you into, all of a sudden, these glorious, religious, golden, amazing objects. It felt like every day during install we were opening another crate full of gold.

NT: And how did E.V. [Day]'s friend describe it?

KC: "This show is so metal." [*laughter*] Opening crates full of gold and, you know, a little bit of rock and roll. But then there's what Glenn was talking about, this language of diagrams. We in the Manuscripts Department at the Getty are nested in an art museum, so naturally we like the gold, glittering, scintillating objects; the diagrams were initially less exciting. And yet, the more time that we spent with art historian and historian-of-science friends and colleagues, who spend their careers on these kinds of visual constructions, we have come to look at our collection in a new way. For instance, there is this one late Ottonian manuscript that has an image of a Pentecost (fig. 11). Glenn calls it his favorite manuscript. It's of this moment when the Holy Spirit, represented by a dove, descends upon the apostles and flames appear above their heads, and they are all given the power of speech. We placed it in the exhibition's section "Light and Vision" to illustrate medieval ideas about light traveling in rays and lines. But now when I look at it, and more generally at medieval representations of the heavens, I will forever see diagrams of the nested spheres of the universe. As Glenn mentioned, the preceding section, "Astral Light," included numerous images of the spherical universe. Medieval people represented planetary motion around the earth as concentric circles, with each planet on its own track. In this case we have only the lower half of the larger heavenly sphere visible, but you could still interpret it as an echo of scientific understandings of the cosmos.

FIG. 11. — Miniature depicting Pentecost, from a benedictional (text in Latin), Regensburg, Ottonian Germany, ca. 1030–40, tempera colors, gold, and ink on parchment. Los Angeles, J. Paul Getty Museum, Ms. Ludwig VII 1 (83.MI.90), fols. 47v–48. Photograph: CC0 1.0.

NT: So, as Glenn mentioned, a big part of this show is the very intertwined nature of religious imagery and the diagrammatic language of science, the knowledge that science was coming up with about sight and light. And it's like Kristen said: We're seeing our own collection in a new way. One pairing that really strikes me is our English Apocalypse [*The Twenty-Four Elders Pay Homage to the Throne of God* in Getty Apocalpyse, possibly London, ca. 1255–60], which we displayed right next to Roger Bacon's *Geometrical Diagrams of Rays Entering the Eye and Striking the Crystalline Humor* (1275–1300).[10] Bacon was a Franciscan writing about light, and he was quoting Ibn al-Haytham, Islamic polymath and scientist who was writing in the 1030s or so. By Bacon's time, Al-Haytham's text had finally been translated into Latin, and Bacon was interpreting it in his own book on optics. He's a Franciscan, and he's a teacher at Oxford University, but at the same time he was adding to Ibn al-Haytham's text, talking about light operating as "species" and also how light gets intensified when it goes through a small aperture. And we have a picture of that in our English Apocalypse: John the Divine seeing his revelations through a little hole in the frame of the image itself. So we now read it as his visionary experience of seeing the end times as being intensified—like light—into his own eye.

KC: The final section of the exhibition is "Aura and Performance," and it contains the germ of our initial idea to bring movement into people's consciousness within a museum exhibition space. Here we talked about moving objects, moving light—whether the quick flicker of artificial light like lamplight, or candlelight, versus the slow sweep of sunlight over different kinds of medieval environments, including the mosque. We looked at architecture in the mosque. We became fascinated with muqarnas, which are dimensional geometric forms that are used to create the domes and squinches of mosque spaces and Iberian synagogues. The light traveling through these premodern spaces creates a lot of cast shadow, and so this is a whole other dimension of light that we are looking at. This might be a good time to mention Farmanfarmaian.

GP: Monir Shahroudy Farmanfarmaian was an Iranian artist who had an incredible history. She was living long stretches of her life in the United States and then back in Iran. She had her first exhibition in the US in the 1950s and was friends with all the abstract expressionists, and Andy Warhol, and so many other artists. She brought artists like Robert Morris and Marcia Hafif to Iran and showed them around in the late '60s or '70s, when she was back living there. In parts of Iran, there is an incredible architectural tradition with mosques that are encrusted in mosaic mirrored surfaces, and they sometimes even include reverse-painted glass. Monir incorporates both elements in her own work, and our exhibition features a dazzling corner-based piece [*Untitled (Muqarnas)*, 2012] that she made, I believe, when she was ninety years old, close to the end of her life (fig. 12). It's definitely one of the great selfie opportunities in the show. It sets you in motion: the more you move around it, the more you perceive the light moving across the surfaces. As I say during tours, sometimes the motion is you. It's your own actions that are making the light move.

NT: In that section we leaned into how surfaces and materials performed in different kinds of light. Among medievalists, there's a phrase that has been coined that talks about the "saturated sensorium," and this is where the neuroscience connection comes in, too.[11] It's the idea that light or sight is considered primary. Sight is completely necessitated by light and contrast and darkness, but then it goes in and gets processed in the brain's various chambers. According to how people in the Middle Ages understood the brain, there was first the common sense, the *sensus communis*, at the front of the brain, before the other chambers: the imagination and then the memory. And today neuroscientists have this phrase called "predictive processing" to describe the brain's process of anticipating perception based on our memories of an experience. So we're bringing all this together for this last section on the "Aura and Performance" of these objects.

KC: Yes, and Gabi [G. Gabrielle] Starr, a specialist in cognitive neuroscience, was a member of our scientific committee, and her initial discussion about the conditions under which the brain experiences surprise as something pleasurable was hugely formative. As she put it, in earlier times, a surprise would be something that wanted

FIG. 12. — *Untitled (Muqarnas)*, 2012, by Monir Shahroudy Farmanfarmaian (Iranian, 1922–2019), installed in the exhibition *Lumen: The Art and Science of Light.* Mirrors, reverse-glass painting, and plaster on wood, each section: 149.8 × 155 × 30.5 cm. Atlanta, High Museum of Art, 2019.174, purchased with funds from the Farideh and Al Azadi Foundation. Photograph © J. Paul Getty Trust, 2024.

to kill you, or eat you, or possibly both. But the brain on light in medieval spaces could create this sense of wonder because it would have been, I don't want to say disruptive, but a marked change to come out of a personal space or home lit by a single lamp made out of tallow or oil and walk into a massive architectural space ablaze with artificial light. Even throughout the liturgical year, it's not something you could predict because

light was never stable. Some religious feasts got two candles; some had more. So the element of surprise would have added to the sense of wonderment and religiosity.

In this section we also have one of the great reunions within the exhibition, thanks to our colleagues Stefano Roffi and Davide Gasparotto: Gentile da Fabriano's *Coronation of the Virgin* (ca. 1420) and *Stigmatization of Saint Francis* (ca. 1420).[12] These two halves of Gentile's processional standard for the church of San Francesco in Fabriano, Italy, had been separated since at least the nineteenth century by the art market. The works formed a two-sided panel carried in procession. We [J. Paul Getty Museum] have the *Coronation of the Virgin*, but the other side depicting Saint Francis is in the Fondazione Magnani-Rocca, outside of Parma. We were able to organize this loan and bring the two of them temporarily back together once again, back-to-back as they originally had been. This was how they would have been experienced by viewers, when they were still functional liturgical instruments. As Nancy has pointed out, and as art historian Chris [Christopher R.] Lakey says in the catalog, the very different surface treatments on each side of this processional panel have drawn attention over the years.[13] The *Coronation of the Virgin* is much more detailed versus the simpler and larger passages of gold on the Saint Francis side. Some try to make a chronology argument or a workshop argument to explain why this might be, but in his essay, Chris argues that it was ultimately a product of function: one side was meant to be viewed outside during daytime feast day processions, and the other was displayed on an altar by candlelight in an interior. So that's just one of the many works in the "Aura and Performance" section that needed custom lighting treatments, to evoke these different environments.

NT: You were going to talk about the Stavelot [Retable]?

KC: The show ends with the Stavelot Retable, a panel that would have sat along the back of the altar table in the royal abbey of Stavelot in Belgium (the abbey no longer exists) (fig. 13). It is a somewhat unusual Pentecost scene, in its inclusion of Christ seated on a rainbow above, and has golden rays descend to the apostles.[14] It's gilded copper repoussé, with the apostles, in quite high relief. The altar is the subject of a study by Bissera Pentcheva, who is a professor at Stanford University. She has written about the optical and acoustic aura of the Stavelot Retable and the way that it would have optically shifted in different lights, with the figures' features shifting in the changing light throughout day and into the evening.[15] And so we had said early on that we did not want to activate the show with artificial candles—

NT: —however tempting!

KC: And yet we decided that we would break that rule just once, and with Glenn's support, too. *[laughter]* Early on [in the process of curating the exhibition] he made a great statement about rules, that they could be broken just once.

FIG. 13. — Installation view of the third section of the exhibition *Lumen: The Art and Science of Light,* "Aura and Performance," with the Stavelot Retable, Mosan region, ca. 1160–70, embossed and engraved gilded copper, champlevé enamel, vernis brun, red jasper, rock crystal and glass replacements over wood core, 85 × 215 × 11 cm. Paris, Musée de Cluny, Cl. 13247. Photograph © J. Paul Getty Trust, 2024.

GP: You have to set rules when you're doing a show because you have to contain it in some way, but you can always break them at least once. *[group laughter]*

KC: We worked for the first time with this amazing outside team of lighting designers, from a company called Available Light.[16] They were a great team who loved the narrative behind the light. On the very last day of the installation, they programmed the moving lights that give an impression of how the Stavelot Retable would have looked over the course of the day and into the evening, in a compressed two-and-a-half minute span. And I said to one of the lighting designers, Damien Perard, "I think we have a little too much candlelight here. You know, candles were expensive. I'm not sure even a royal abbey would have had a whole row of candles all along the bottom of the altar." He was like, "Ok, this is good. The story is really important. We'll dial back on candles." And I loved that. We appreciated working with people who absolutely threw themselves into the scholarship, particularly Pentcheva's work, and came back asking for more.

The retable is on display next to the whole row of manuscripts that talk about the neuroscience of light. Our way of bringing performance and the science of light together is meant to slow the viewer down so they can observe and let the optical changes brought about by light seep into their mood and experience of the exhibition.

NT: We should add how essential the design team (both our in-house designers headed by Alan Konishi and the consulting lighting team that Alan brought in) was, and the fact that the museum was so committed to the show to bring in lighting specialists for the first time. They realized, of course, if there was ever a show to have it, it would be one about light—

KC: Light, right?

NT: Right. And these were professional lighting designers who come from a theater background, and they know how to create drama with lighting. Not to mention the lighting is hidden in the incredible display case that our own Preparations team built (with the lighting built internally in the case). The case lighting is achieved by little, computer-controlled LED lights—incredibly sophisticated, the likes of which we've never done before.

But this [the Stavelot Retable] is an object that was completely worth going to these extra lengths for, activating what Bissera [Pentcheva] had written about and illustrated in a journal essay and in the *Lumen* catalog.[17] So the fact that we could bring this to our audience—an object with light raking across its surface, changing over time—we want them to sit down and slow down long enough to watch it.

KC: We were so lucky to have a designer who has a background in architecture as well, because Alan Konishi, in doing the design for that amazing case, was a huge part of it. He, along with his colleague Chaya Arabia, worked on two large and really ambitious contemporary installations as well as all of the historical medieval art. It was like conducting an orchestra—there were so many moving parts involved. And speaking of orchestra conductors, Amber Keller [Head of Exhibitions at the Getty Museum] was a major factor in the success of this exhibition. When doing a show on this scale you need, not just technical and logistical support, but someone who believes wholeheartedly in the project and knows what the team can accomplish.

GP: Maybe this is a good moment to address the seven contemporary works in the show, plus an eighth piece that we say is "emotionally included." There are two that are separate from the main part of the exhibition—in the ideal situation, one will be the first piece you see, and the other will be the last. We do see the rotunda commission as the first piece in the show, because you can't go into the show without walking through it; it's a piece by Charles Ross called *Spectrum 14*, and there are fourteen of what may be the largest solid material prisms ever fabricated mounted into our ceiling at very precise angles (fig. 14). So any time during daylight hours that you walk into that rotunda, you will see at least one or usually quite a few spectral bands of light hitting the floor, or the wall, or you, or other spaces in there. It's different every day because the sun moves differently every day. And there are what Charles refers to as summer prisms and winter prisms, because they will only be hit at certain times of year.

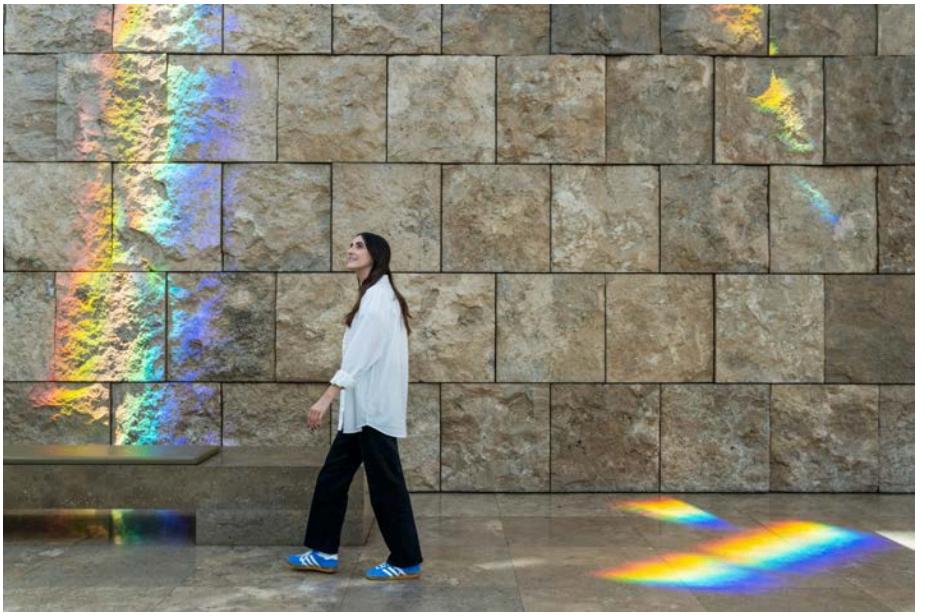

FIG. 14. — A visitor to the Getty Center in Los Angeles looks at *Spectrum 14* (2024) by Charles Ross (US American, b. 1937), fourteen acrylic prisms tuned to the sun and suspended in skylights, part of the exhibition *Lumen: The Art and Science of Light*, 2024. Art © 2025 Charles R. Ross / Artists Rights Society (ARS), New York. Photograph © 2024 J. Paul Getty Trust.

GP: I had a feeling about how this piece was going to work, and it's turned out to be so different, because the spectra moved way faster than we ever would've thought. In the summer, they're moving about six inches a minute. Spectral light, because it is dispersed and covers more ground, moves at twice the rate of a normal sunbeam. So if you really slow yourself down and look at it, you can actually see the movement. And that is the rotation of the earth that you're seeing. And when you come back the next day at the exact same time, they are going to be in a different place than they were the day before. When Charles told me that, I was like, *Sure, by maybe millimeters or centimeters*, but in the summer—which, again, the summer is the most active, most chaotic time—sometimes it was a difference of a couple feet. They really, *really* change a lot, and that change is the orbit of the earth around the sun. So, the piece is measuring two types of planetary movement. One is something that we can, if we slow down, perceive the first time we visit it. The other you have to visit the piece over and over again, over the course of a year, to really understand.

And there are multiple connections to the show. One: we needed rainbows, basically. If you pay attention in the show, in so many of the depictions of God, he's either sitting on a rainbow or surrounded by rainbows, or both. The rainbows aren't always in color; sometimes it's just the shape. Now that I know that, I see it everywhere. This notion that a rainbow might be surrounding the divine and pointing to it is so perfect because you can never get to the rainbow, right?

Two, you walk into the show, the first things you see are the devices that people used to help them know the date or when sunrise or sunset is going to be, or to help them navigate. Our predecessors, by necessity, had to be more connected to the cycle of a day or the cycle of a season. We don't have to do any of that; we have phones in our pockets that tell us. For someone who really wants to slow down and give their attention, the piece will let you feel a little bit more connected to what we now know as planetary motion (back then it would have been considered the movement of the sun). You then go in to the exhibition to see all the centuries of achievements that led to that. *[Pause]* So that's the first one [contemporary work in the show.] *[laughter]*

NT: Yes, just to say about rainbows, besides God being surrounded by them, there's also an active scientific inquiry into their nature at this time. By 1300, you already have diagrams of how light reflects and refracts through and off the backside of a raindrop, as given in a treatise on the rainbow by Theodoric of Freiburg.[18]

KC: And Theodoric was hugely important for us because he's how many hundred years—?

NT: Nearly three hundred and fifty.

KC: *Centuries* before Sir Isaac Newton's experiment with the prism.

KC: We have good old Theodoric doing his experiment by filling glass globes with water and looking at how light reflects through them, as if they were a single droplet of water hanging in mist, forming the rainbow.

KC: Nancy always says, "He didn't get it quite right, but. . . ."

NT: He thought colors mixed in the eye, which was very intriguing.

KC: Yeah. But these Enlightenment stories that we're told, they really obscure all of the ways that medieval people, for centuries, were working on these problems.

NT: Right. Like we have Witelo's synthesis on optics, the *Opticae thesaurus*, from circa 1270. Witelo is also a Franciscan, and he's working at the papal court in Viterbo. He's gotten his hands on a copy of Roger Bacon's *Perspectiva* (dated 1267), and he's synthesizing Bacon along with much of the ancient corpus on optics and geometry, along with a commentary on Ibn al-Haytham's treatise on optics. Witelo's compendium was such a great synthesis that it continued to be copied and printed well into the sixteenth century, and we know that Johannes Kepler studied it, and so did many of these much later, early modern scientists and theoreticians.

GP: Well, the final piece in the show is an installation by Helen Pashgian. Kristen was talking about the surprise of this transition of walking from your everyday life into some enormous cathedral. We can bring a lot of amazing things into the galleries, but

a medieval cathedral isn't one of them. And so this final piece, it accomplishes a lot of the same things (fig. 15). A transporting environment, but carried out through opposite means. So instead of creating that wonder through an accumulation of ornament and figuration, it's done by removing information. It's incredibly minimal.

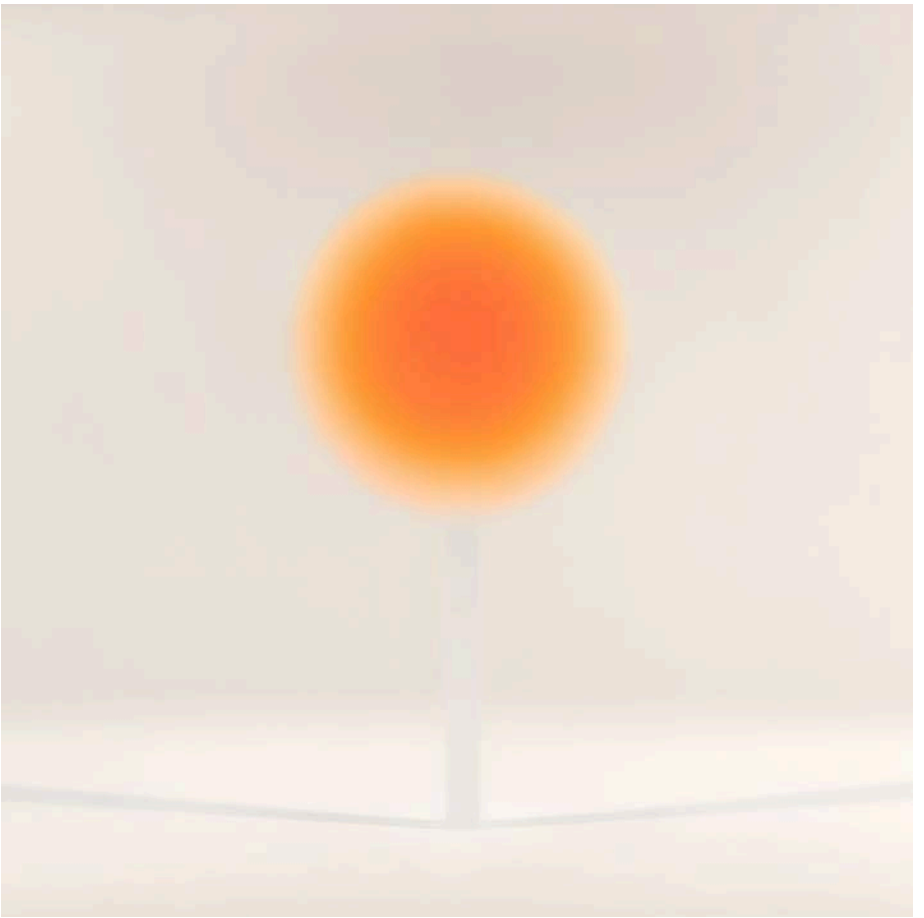

FIG. 15. — *Untitled (Lens),* 2023, by Helen Pashgian (US American, b. 1934), an installation for the exhibition *Lumen: The Art and Science of Light,* 2024. Cast urethane, diam: 127 cm. Photograph courtesy of the artist. © Helen Pashgian.

In the middle of the space, it's a disc-shaped sculpture whose edges are so thin that you can't quite tell where the sculpture ends and where the room begins. And then we've removed the corners from the room, and we've removed the join between the floor and the wall, so everything's curved. You lose your sense of depth because you can no longer tell where the walls and floor actually connect. Pashgian says that the eye is always searching for an edge, and when we don't find it, I guess there's a bit of unease as we try to locate ourselves. I think that's the beginning of this transporting experience. The lights in the room change. In about a five-minute cycle, they get brighter and darker, and they ultimately go almost totally dark. And as you're looking at this disc, you suddenly

begin to see that it has a halo, this sort of aqua-colored halo, that seems to be moving. Every time you move your eye, it moves: that's your eye producing afterimages.

And so the piece is a communion. Part of what we see is what is actually there. And part of what we see is our bodies' own reaction to what we're seeing. It was common with Light and Space artists, pushing things to such a minimal extreme that our own processes of perception become part of the experience. That's certainly the case here.

And then my big realization this week. In the middle of the show, in the section about vision where there's the incredible Danish altar and then, on top of it, a monstrance, Kristen and Nancy always talk in their tours about the physicality of vision and how you could do ocular communion. Helen's piece is kind of that: it is an ocular communion, and it is emphasizing this physicality of vision. In the catalog I wrote that it's pieces like Helen's that could help you realize why earlier scientists thought that vision may be something coming out of the eye, that afterimages could lead to ideas like that.

KC: Yeah, for us that piece so beautifully captures some of that early experience that Nancy and I had at Saint Catherine's, where you had changing light moving pretty quickly throughout the morning and shining through an aperture onto an altar. It was obscuring or confusing your vision as much as it was illuminating, because the dazzling light was blurring edges of objects on the altar. And the feelings provoked by watching light perform in that way were quite powerful and, in many ways, akin to Light and Space installations. When you are immersed in these environments you get a little bit of that sensory confusion that the medieval liturgy provided. So I think we knew that we had to have at least one in the show that would provide the full surround.

NT: Working with Helen was so great because she is just across town in Pasadena and has a space built out, just as Glenn described. We could go to see a whole variety of discs in her studio of different hues, different intensities. And we all discussed which one would be best for our audience, people who would be popping in maybe even before they see the exhibition. Of course, we wanted this to be seen at the very end, so we went for the one with maximum impact on the eye: a beautiful, big, bright-orange disc.

GP: This piece was a difficult build-out. It's hard to make a room with no corners, and our building makes it even harder. There are structural aspects of our building and the way our air-return system works that make building inside of the gallery difficult. It's partly that it's difficult anyway, and then it's even more difficult here. Ultimately, she said that it was the best build-out that she's been given. The only thing we did was listen to her and do what she asked. That's all we did. We listened to the artist.

NT: It's also worth saying here, both Helen and E.V. [Day] were super excited about being included in a show with historic works, because they're usually in shows with other contemporary artists. And so that was really gratifying, to see how much they saw the resonance of their works with historical pieces.

FIG. 16. — Master of the Retable of the Reyes Católicos (Spanish, active ca. 1485–1500). *The Annunciation* (detail), late 15th century, oil on wood panel, 153.7 × 94.3 cm. San Francisco, California, Fine Arts Museums of San Francisco, 61.44.21.

KC: A conversation with E.V. on opening night had me thinking more clearly than previously about how the language of diagrams infiltrates religious imagery. Pointing to that Annunciation [*The Annunciation,* late fifteenth century, Master of the Retable of the Reyes Católicos, fig. 16],[19] she was like, "It's so naturalistic. It's the highest degree of naturalism for its time and yet you have these stylized extraterrestrial laser beam rays. Why, why?" We were then planning a program about medieval science with our colleague Megan McNamee, who works on geometry in medieval manuscripts and on diagrams. It created a nice prompt for further messaging on the tours about this point that E. V. found so fascinating—this supernatural radiance looks like medieval diagrams of light, which was thought to travel in lines and rays. And it has been really nice to point out to people that we didn't just leave geometry in the first section; it's here in these various religious artworks in "Aura and Performance," which many might see as the most overtly "religious" section of the show.

GP: The piece by E.V. Day, it's the largest in the show (fig. 17). It recreates what the golden rays of an Annunciation might have looked like if they were real. So, in this case, aircraft cable has been gilded and connected to fiber optic monofilament that from a distance becomes invisible. It's certainly our most dramatic sightline in the show, when you have these golden rays descending over the section of the show with all these incredible religious items.

FIG. 17. — Installation view of the second section of the exhibition *Lumen: The Art and Science of Light,* "Light and Vision," with *Golden Rays / In Vitro,* 2024, by E.V. Day (US American, b. 1967). Aircraft cable, gold leaf, monofilament, and hardware. On the wall behind is *The Annunciation* by the Master of the Retable of the Reyes Católicos, late 15th century, San Francisco, San Francisco Fine Arts Museums, 61.44.21. Photograph © J. Paul Getty Trust, 2024.

KC: Well, that was a very fun one to install, putting it into dialogue with the painting [*The Annunciation*]. We installed the painting the second day, and so E.V. was gone by then. It was opening night when she finally saw it.

GP: I was texting her pictures.

NT: That piece [*Golden Rays / In Vitro*] was also brought to life with the lighting-design team from Available Light. They cast a really beautiful amber light on the gilded wires that make them even more scintillating and shimmering and visible from a distance.

KC: Nancy and I had looked at a variety of Annunciation paintings, but this was a late loan decision that came together. And so we secured the loan of this painting after we'd been working with E.V. for a while, and then E.V. found out which one it was, and it turns out this painting was in her archive—her photo archive—as an image that she had

been interested in. Bringing those two together, they had this zap of connection. They function together as an installation.

GP: Her piece was first made in Rome when she was artist in residence at the American Academy in Rome, and she installed it in her studio, which is a very grand space. The gold cables started inside and extended out her window about another forty feet. So there were a lot of steps involved in bringing it here.

I would credit E.V. for the extent of our lighting design, since the work was really an outdoor nighttime piece illuminated by flood lights below. Talking to her about the piece, she said, "The context of *Lumen* is so perfect for my Golden Rays installation. The cables are like the body of God's voice pulled out of the medieval Annunciation painting in the show! It plugs right into that whole shimmering machinery of devotion." She said, "I would love to do this—this is a dream, absolutely—but I need a lighting designer. I think that's the only way. The only way I know how to do this piece is for it to be dark, and then I just blast it with light from underneath." And, I was like, "Well, I don't think you can blast anything in a gallery full of medieval manuscripts!" And she said, "I also don't know where the shadows would land when contained by walls. I would love to make this work, but I need professional assistance to really get it to work in your gallery space" (fig. 18).

GP: We were probably already talking about a lighting designer at that point, but I'm sure that was when I started thinking, *Oh god, actually everything in the show needs a lighting designer*. But that's another case where we simply listened to the artist. Unfortunately, that can be very rare, and it's even more rare with women artists. Often, they say exactly what they want, and the institution starts trying to talk them out of it, because it's going to be more expensive, you know. But that piece is so dependent on every little thing being done perfectly—which of course the artist knows better than anyone. You can't bargain your way—well you'll bargain your way into a failure if you don't give it what it needs.

KC: Yeah, we were lucky that the museum went all in on this show and recognized that a show on light needed the Available Light team! *[laughter]*

GP: Maybe this is a good opportunity to circle back to the eighth contemporary work in the show, the one I described as emotionally included. In the rotunda, Charles Ross's work is measuring two types of planetary movement, right? The daily rotation and the yearly orbit. But there's a third type of planetary movement that he has spent the last fifty years of his life trying to visualize. If you've ever spun a top and then the top starts to wobble—our planet does the same thing, and one wobble takes twenty-six thousand years to happen. Charles has made this incredible work of land art that helps to visualize this phenomenon, which our medieval predecessors called the precession of

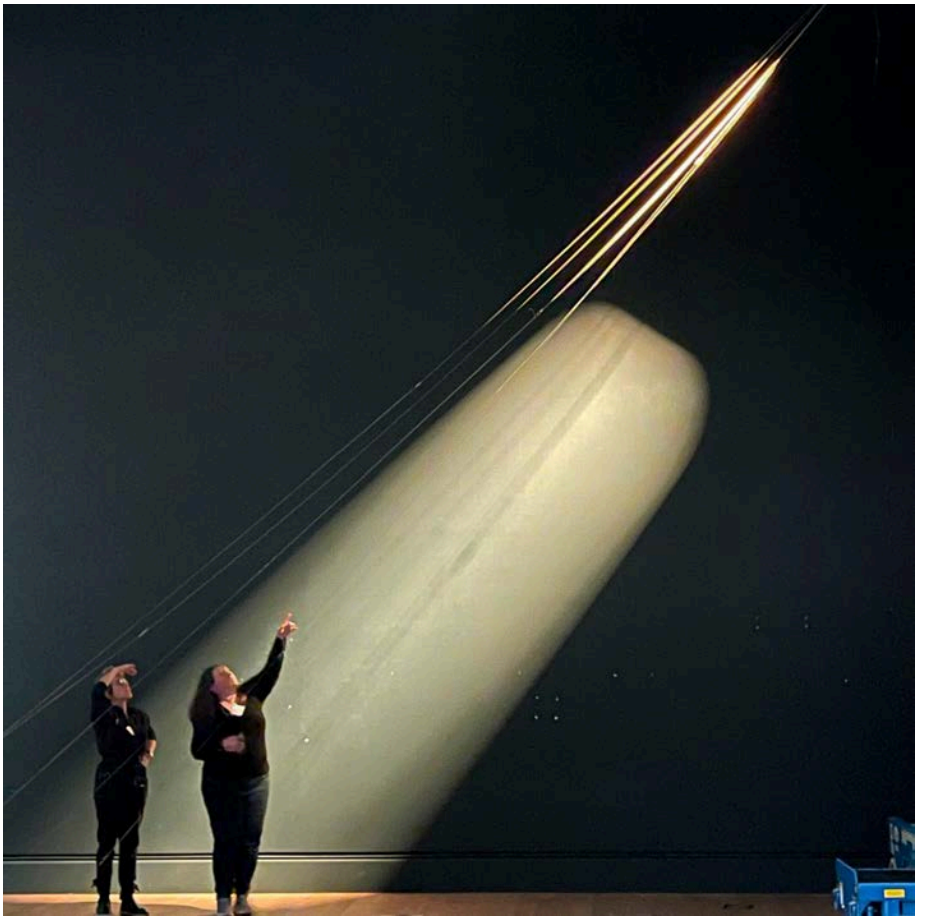

FIG. 18. — Preliminary planning exercise for the installation of E.V. Day's *Golden Rays / In Vitro*, 2024, in the Special Exhibitions Gallery at the Getty Center in Los Angeles, with E.V. Day and lighting designer Kate Furst, February 2024. Photograph © J. Paul Getty Trust, 2024.

the equinoxes. I said it's emotionally included in the show because it's sitting on a mesa in New Mexico (fig. 19). *[laughter]* We can't bring it here.

But it's a moment in the show that I love because, at the very center of the *Tapestry of the Astrolabes,* there is the North Star, Polaris represented with a little circle around it (see fig. 3). Right next to that, there's a manuscript depicting a monk using a device called a *horologium nocturnum* to tell time at night.[20] You point it at Polaris and then, based on where the stars are around it, you can tell the time at night. And so *Star Axis* by Ross is also a sighting tube that is aimed at Polaris. It's an eleven-story pyramid, and at the top is an oculus that is framing Polaris directly. Each step going up has two sets of dates engraved: a date in the future and a date in the past, and so as you walk up, as you approach the oculus, it's getting larger in your field of view. The perimeter of the oculus is framing how far Polaris will move over the course of a night on the date that is engraved on the steps. When you are at the bottom of the steps, which is close to the

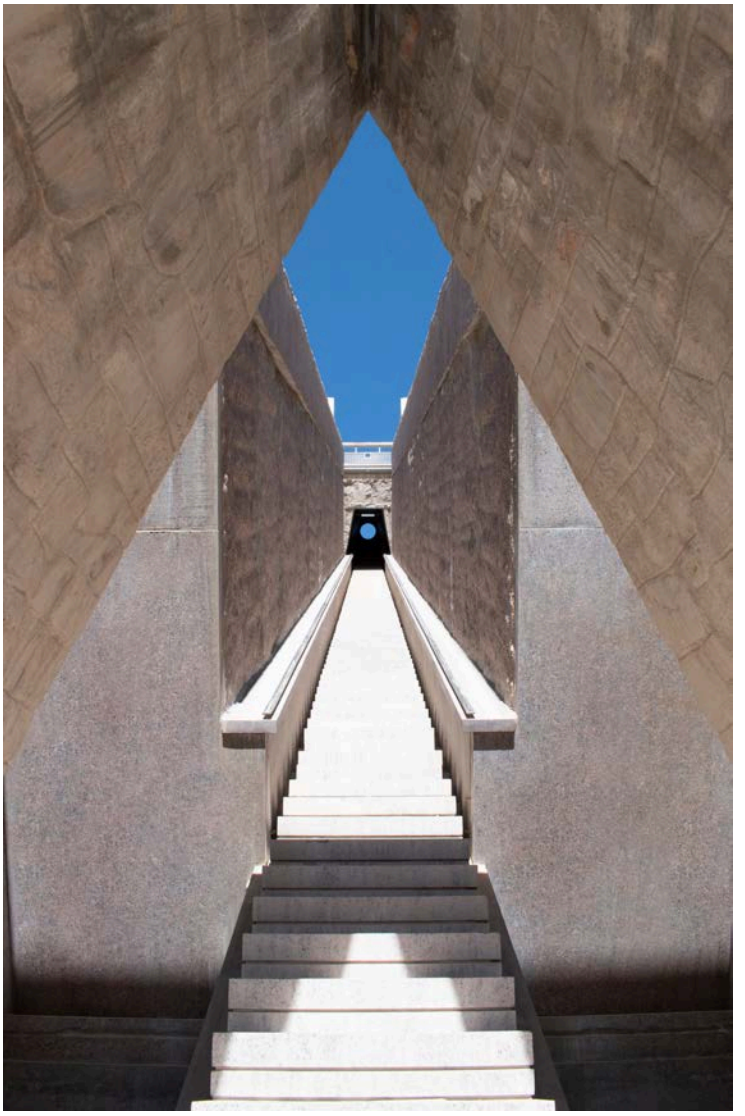

FIG. 19. — Charles Ross (US American, b. 1937). *Star Axis,* 1971–ongoing, granite, sandstone, bronze, stainless steel, earth. View looking up the Star Tunnel. Art © 2026 Charles Ross / Artists Rights Society (ARS), New York.

present, the oculus is very small, and indeed Polaris moves very little over the course of a night right now, which is why it is our North Star. But because of this twenty-six-thousand-year wobble, the North Star changes over time. In a couple thousand years we'll have a different one, and then another one a thousand years after that, and so on. As you walk the stairs and get closer to the oculus, it gets larger in your field of vision, showing you just how much our planet wobbles over time. So you're tracing geometry in time, and when you get to the top, you witness the farthest that the wobble ever is.

When you're at the very top, which is depicting the orbit of Polaris thirteen thousand years in the future and thirteen thousand years in the past over the course of one night, it actually falls and goes below the horizon line at a certain point, and comes back up. Just the process of climbing this set of stairs allows you to visualize that twenty-six-thousand-year cycle. The extent of that cycle began to be discovered in the Middle Ages as astronomers compared their measurements with Greek astronomy and realized that the numbers were different. Enough time had passed between ancient Greece and the Middle Ages that the difference was now measurable. And they had so much respect for their predecessors that instead of saying "their measurements were wrong and ours are right," they said, "The entire planet must be moving"—and that was the right answer! I remember vividly when I first brought Ross to Kristen and Nancy's attention, and they read about his work, Kristen's first reaction was, "He knows about the precession of the equinoxes!"

KC: That was my fangirl moment! *[group laughter]* I had a houseguest recently who picked up my copy of Seb Falk's *The Light Ages: The Surprising Science of Medieval Science* (2020) and noticed my Post-its flagging the section on the precession of the equinoxes. I remember absorbing all of this astronomy for the first time. Then to be able to go to a site where an artist had decided that this was the thing that he would show generations of people to come is pretty amazing: How this polestar that we call our true north, the star by which we navigate, *is not that*. And then to put you in this stairway and have you climb up through time—one hand on a rail marking the past and one hand on one inscribed with a year in the future—was a mind-bending experience.

NT: Which had to be done in the pitch black of night, right, so there's no ambient light. This was even before the moon came up, when we were there.

GP: And one at a time, because if anyone's ahead of you, they're going to block the oculus.

NT: Charles [Ross] and his partner, Jill [O'Bryan], said, "Let the polestar pull you up." We could hear our footfalls. We could hear each other's breathing because it was dead silent.

NT: But you don't want to take your eyes away from Polaris, because it's above you and then it's not. You're in this dark tunnel, and it's a little freaky. And it was just so moving emotionally. I mean, the artist spent fifty years, his adult lifetime, building a pyramid to make this point and physicalize it. And you feel this in your body. I mean, he's making this knowledge tactile.

GP: I think the whole perspective of the show is really how much effort it took over generations for humankind to figure this stuff out. That has always struck me: the enormity of some of these achievements that we take for granted, which now you can just tell somebody. Right?

All to each other: Right? *[laughter]*

KC: But what a once-in-a-lifetime experience that was! It took us from immersive environments filled with light to extreme darkness with one little pinpoint of light.

KC: It's funny because, you know, so much of the work that Nancy and I did on the last part of the show on medieval sensoria involved being bombarded with scent and sound and light. It was somewhat overkill, a smorgasbord of sensory experience. And then to go into this space that was like a sensory deprivation tank—that moment when you're in the viewing tube with only the pinpoint of Polaris was, I found, a little scary in a delightful way; it was a little overwhelming.

NT: Well, it was awesome! It really was about the *awe*.

GP: Yeah.

KC: As we rode down the mountain, we all ruminated on these moments in the careers of art historians where we think of just how lucky we are that we work on this stuff.

NT: Because the show has taken us in these directions we could never have anticipated in the beginning.

KC: And I mean, every great project does that, right? It surprises you somehow. I definitely feel like this stretched us to take on science—so thank you, Getty Foundation! *[laughter]* I still don't know my constellations, but I can recognize them in a medieval manuscript. Out in the field, I'm a little more limited. *[chuckles]* I feel like the catalog just scratched the surface in so many ways. There was this whole field of study that, because I was not good at math or science in high school and earlier, I peeled out of it as soon as possible in college. And there's this whole area of our collection that could use some amplification and study. It's fair to say, I'm not going to become a historian of science, but there's definitely cataloging work and further shows to be done with this kind of material in the Getty's collection. So I'm looking forward to that, which is a hard left from where I was before, the land of devotional touching and kissing of medieval books.

GP: My feelings about incorporating contemporary art into historical shows have changed a lot. I'm always happy to see it, but if you think back to moments when you've encountered it in shows, it's not always as successful as one maybe would hope. You can end up leaving a project worried, *Oh, God, am I going to get clobbered?* Because when we see it not working as well as it could've. . . . Those curators probably thought it was going to work, right? But this project brought me to a place where I now feel that there can be a kind of methodology to it, that there's a reason for it, and that there's a way that it could be done—

KC: Done sensitively, right?—

FIG. 20. — Installation view of the exhibition *Lumen: The Art and Science of Light,* with *Untitled (Parabolic Lens)*, 1971, by Fred Eversley (US American, 1941–2024). Three-color, three-layer cast polyester, diam: 92.7 cm. New York, Museum of Modern Art, acquired through the generosity of Michael S. Ovitz and Gary and Karen Winnick, and Committee on Painting and Sculpture Funds, 782.2017. Art © Frederick Eversley. Photograph © J. Paul Getty Trust, 2024.

GP: Done sensitively. I think if it's a historical show with contemporary art added, then the primary needs to be the narrative of the main show, and the contemporary pieces should not try to compete with it. And I think sometimes that's what happens—the newer work tries to take over. We're using the contemporary works in some cases to bring a little bit of scale and wonder. But you should want the things to play well together, and you should want them to enhance the narrative. You want the pieces to make a light bulb go off in somebody's head, not a question mark. Shows like this are not the moment for thwarting or twisting or complicating the narrative. So I think finding the right people who can help show that historical ideas are relevant today, or that artists can use some of the same ideas is, in my opinion, how it can work. I think here of Fred Eversley's glorious lens sculpture in the show (fig. 20). It's such a knockout object, but we placed it so that it was reflecting, encompassing, and showcasing all of the other amazing crystal objects in the show, and by the time people reached this object they would (we hope) associate the colors and form of the work with the nested spheres of the universe that they had already encountered several times. It felt harmonious, while also allowing for a great moment of interactivity and wonder.

KC: I think having a full consideration for ways that all of these works acted as lenses—lenses through which you could better understand the larger narrative that we're trying

to tell—was really important. They weren't just representational; they were didactic, helping us to tell a story and prompt consideration of our themes.

GP: Most of the contemporary pieces are completely abstract, except for one painting of stars. The imperative was to use an object to create a perceptual experience that is going to relate to what else is happening in the room. Maybe the strongest example of that was Anish Kapoor's *Non-Object Black* (2018) being placed in the "Divine Darkness" section of the show.[21] This was probably the most abstract and "difficult" section of the show, asking visitors to think about the impossibility of ever being able to comprehend the divine. It's something we can only glimpse in fragments at most. And then we have this Kapoor sculpture coated in Vantablack, the darkest substance on earth. It looks like a flat, two-dimensional diamond shape, until you move around the box and realize it actually protrudes into space. The sculpture is so black that it has suppressed our ability to perceive depth. So we have to undergo that same process of apprehending something in bits to begin to understand its true form. And then I only understood on our final tour of the exhibition that the Kapoor work is also a reliquary, just like the reliquaries that were near it. Once those sculptures are coated in Vantablack, they get vacuum sealed into that vitrine, and the vitrine can never be opened again.

NT: As for *Lumen*'s afterlives, I've gotten really interested in ocular communion and how sight becomes tactile in the high and late medieval Latin West. I've started looking at how pigments are also medicinal and whether healing could be done through the perception of colorants on the page. That's what I'm exploring right now, visual ingestion, visual healing through these medicinals on the page. It's bringing me back to what I know best and the stuff that manuscripts are made of.

GP: I feel like that's a book that could be really successful now, like if you tell people that using inks made from these colorants could heal them.

NT: I gave two talks last year on this, so, yeah, I hope that's my next project to publish.[22] *[chuckles]* Thanks, everyone, for this shared conversation! This was a snapshot, right? We've learned so much since putting this exhibition together.

KC: That's an important thing to be said, particularly at a moment when symposium volumes are becoming more infrequent. So often the really interesting stuff that bubbles up through an exhibition you only come to after the book is out. After you've been living with the show in the galleries, and you've had these really rich conversations. After you've had a study day and sensory activity led by Barry Smith [professor at University of London and founding director of the Centre for the Study of the Senses] while smelling incense and hearing Hildegard Bingen in the galleries! I think there are all kinds of exhibition afterlives that continue to ripple, and it remains to be seen how we capture them.

Kristen Collins is curator of manuscripts in the Getty Museum.

Glenn Phillips is chief curator at the Getty Research Institute.

Nancy K. Turner is conservator of manuscripts at the Getty Museum.

Notes

1. *Holy Image, Hallowed Ground: Icons from Sinai,* curated by Robert S. Nelson and Kristen Collins, Getty Center, Los Angeles, 14 November 2006–4 March 2007. See Robert S. Nelson and Kristen M. Collins, eds., *Holy Image, Hallowed Ground: Icons from Sinai*, exh. cat. (J. Paul Getty Museum, 2006).

2. Nancy K. Turner, "Surface Effect and Substance: Precious Metals in Illuminated Manuscripts," in *Illuminating Metalwork: Metal, Object, and Image in Medieval Manuscripts*, ed. Joseph Salvatore Ackley and Shannon L. Wearing (De Gruyter, 2022), 51–110.

3. "PST ART: Art & Science Collide," Getty, https://www.getty.edu/projects/pacific-standard-time-2024/.

4. Nancy Thompson, G. Gabrielle Starr, and Abbey Stockstill, moderated by Barry C. Smith, "Art, Science, and Wonder in the Medieval World (Panel 2: The Neuroscience of Light)," Getty Center, Los Angeles, 10 November 2024, https://youtu.be/vfl_6cNVuZ4?si=V72pZ6c-dodYbyPe.

5. Rebecca McGrew et al., *It Happened at Pomona: Art at the Edge of Los Angeles 1969–1973,* exh. cat. (Pomona College Museum of Art, 2011).

6. Kristen Collins and Nancy K. Turner, eds., with contemporary contributions by Glenn Phillips, *Lumen: The Art and Science of Light, 800–1600* (J. Paul Getty Museum, 2024), 224, pl. 114.

7. Collins and Turner, *Lumen,* 53, pl. 27.

8. Collins and Turner, *Lumen,* 218, pl. 107.

9. *Wonders of Creation: Art, Science, and Innovation in the Islamic World*, curated by Ladan Akbarnia, 7 September 2024–5 January 2025, San Diego Museum of Art, https://www.sdmart.org/exhibition/wonders-of-creation-art-science-and-innovation-in-the-islamic-world/.

10. Collins and Turner, *Lumen,* 118–19, pl. 49; 112, pl. 41.

11. See, for instance, Hans Henrik Lohfert Jørgensen et al., *The Saturated Sensorium, Principles of Perception and Mediation in the Middle Ages* (Aarhus University Press, 2015).

12. Collins and Turner, *Lumen,* 232–33, pls. 123, 124.

13. Christopher R. Lakey elaborates in "Dazzling Splendor in a Processional Standard by Gentile da Fabriano," in Collins and Turner, *Lumen,* 195–96.

14. Collins and Turner, *Lumen,* 202–3, pl. 90.

15. Bissera V. Pentcheva, "Optical and Acoustic Aura in the Medieval Image: The Golden Retable of the Pentecost at Stavelot," *Material Religion* 16, no. 1 (2020): 9–40, https://doi.org/10.1080/17432200.2019.1696558.

16. Available Light, https://www.availablelight.com/.

17. Pentcheva, "Optical and Acoustic Aura in the Medieval Image"; and Bissera V. Pentcheva, "Radiant Light and Sound in the Medieval Church," in Collins and Turner, *Lumen*, 187–93.

18. Collins and Turner, *Lumen,* 142, pl. 75.

19. Collins and Turner, *Lumen,* 151, pl. 87.

20. Collins and Turner, *Lumen,* 45, pl. 18.

21. Collins and Turner, *Lumen,* 128, pl. 61.

22. Nancy K. Turner, "Pigments and Dyes, Medicine and Healing: Finding *materia medica* in Manuscript Illumination," in *Visualizing Drugs & Dyes: Art and Pharmacology in (Early) Medieval Worlds (600–1400)*, ed. Theresa Hollar, Matthew Griebeler, and Hannah Baader (Brill, forthcoming); and Nancy K. Turner, "Sight and the Healing Efficacies of Painting Materials as Affective *Pharmaka* in Medieval Devotional Manuscripts," in *The Senses, Cognition, and the Body in Medieval Devotional Practices*, ed. Pieter Boonstra et al. (Brepols, forthcoming).