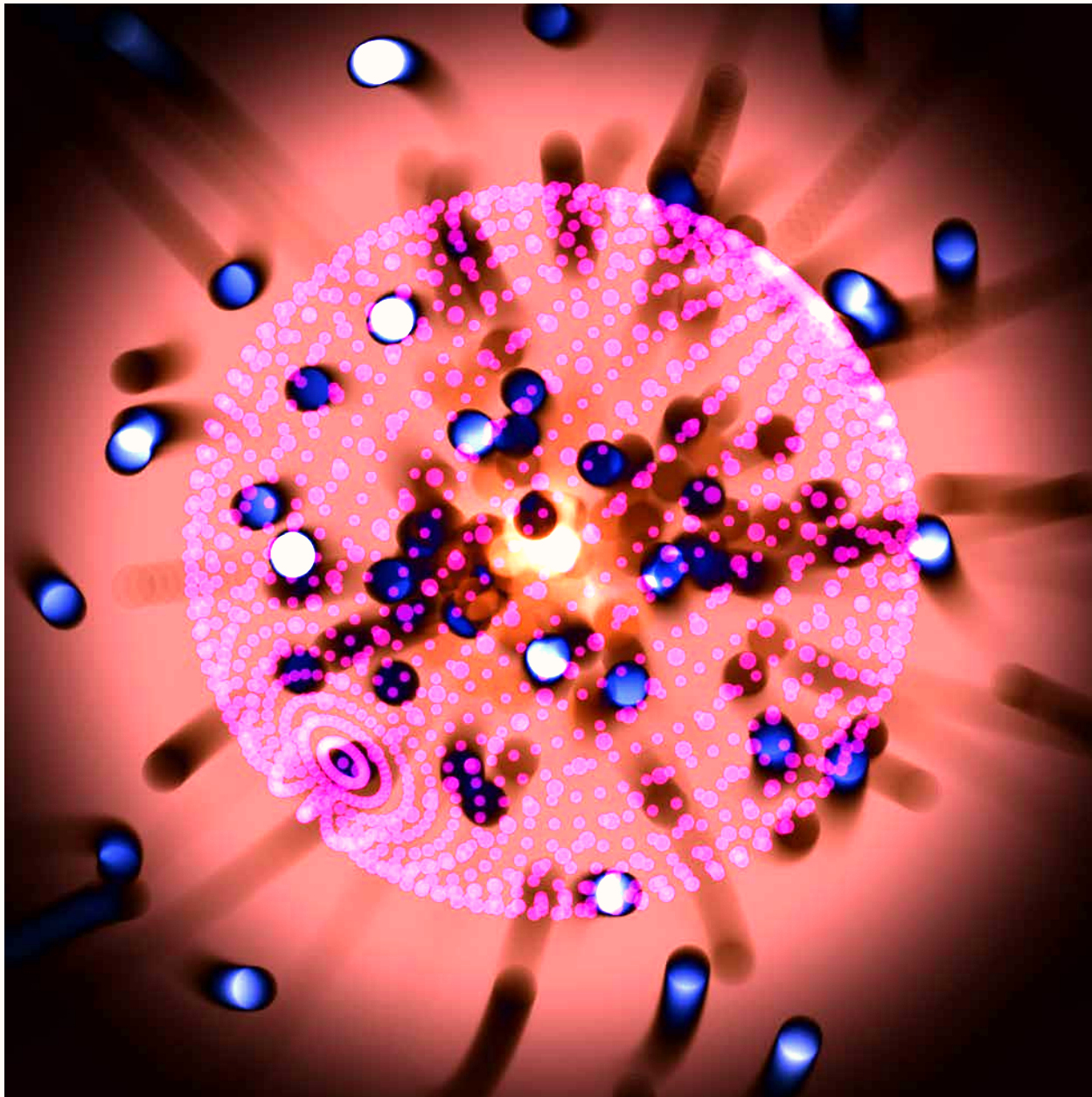# Leo Villareal
Cosmic Reef

Leo Villareal

Cosmic Reef

In Light of Abstraction

by Charlotte Kent, PhD Jack Burnham, an influential writer on art and technology, once claimed that "in an industrial society the role of artistic abstraction is nothing less than the psychic preparation for the entire re-creation of society."[1] Burnham was writing about the ways in which science and technology influenced sculpture, noting how art, like those other endeavors, aims to shape the material world, "motivated by the same pangs of discovery and a desire for the consummation of ideas into beautiful totalities."[2] Leo Villareal's work exemplifies this relationship between art and science. He has described his installations of light as driven by technology and the chance encounter that comes from experimentation.[3] His works emphatically avoid representation, knowing that viewers won't be able to resist pareidolia—the mind's tendency to create intelligible patterns of what it sees, no matter how abstract the sculptural form.
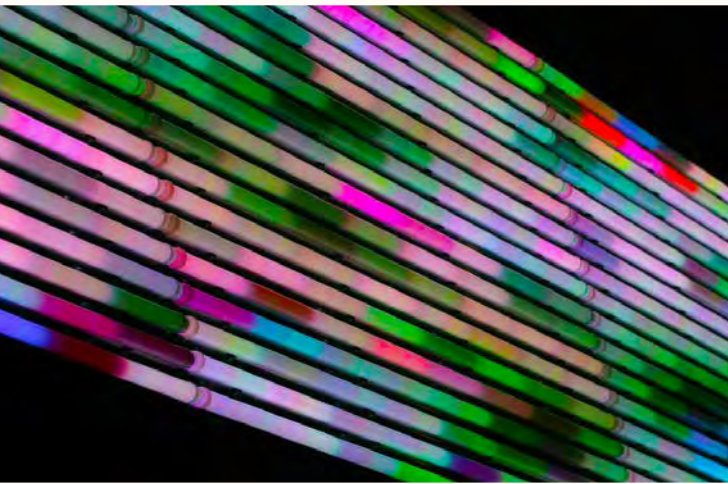
CHASING RAINBOWS/NEW HAVEN
2004
Site-specific installation: New Haven Green
and Yale Repertory Theater's Plaza, New Haven, CT
LED tubes, custom software, and electrical hardware
60 × 96 × 4 inches
Unique

→
RED LIFE
1999
Plexiglass, incandescent orange light bulbs,
custom software, and electrical hardware
36 × 30 × 7 inches
Ed. of 3 + 1AP

His resistance to prescribed meanings provides audiences with space to speculate. Amid the insistent, flashing demands in our mundane use of computers, Villareal's works offer an alternate terrain in which to consider how and what our relationship with technology can be.

Abstraction draws away those characteristics that obscure the essence. In the early twentieth century, art shifted away from narrative and figuration, dissolving such references in favor of a discordant set that includes both the classical austerity of the highly intellectualized line and the romantic exaltation of the spontaneous, irrational, and biomorphic.[4] Surveying Villareal's work, we see both approaches: the terseness of *Line* (2012), a permanent installation of white LED lights along the top edge of MoMA PS1's exterior; and the effusive color and emergent behaviors of his *Chasing Rainbows/New Haven* (2004) for the New Haven Green and Yale Repertory Theater's Plaza.

If abstraction in art focuses attention on the substance of the artist's materials, abstraction in technology manages complexity by condensing information to increase the software's efficiency in producing a desired outcome. It categorizes and generalizes in order to enable particular features and procedures. It hides data as a means of extracting behavior that aligns with the intended usage of that programming layer. Villareal works with a team to design a custom software for each project. By altering parameters, he can generate patterns of all sorts, turning variables on and off from one layer to the next as he experiments to find what he hopes to achieve. It is a balance of chaos and control. Though the visual abstractions common within generative art serve their own aesthetic purpose, they are also indexical of underlying technological abstractions.

One of Villareal's earliest light sculptures, *Red Life* (1999), is an easel-sized panel of incandescent light bulbs that brighten at random behind an opaque sheet of plexiglass that mutes the effect. It was his first use of color and important early adoption of generative systems. Generative art is a form of computer art that automates certain elements of the work by establishing rules that a self-governing system (like a computer) can then follow. The method focuses on designing processes rather than outcomes; the behavior may be programmed but it typically retains numerous, sometimes countless, executable pathways at each step. The generative approach is largely associated with abstractions of line, shape, color, and pattern, but it can produce figurations. *Red Life* can be seen as a portrait of the underlying code.
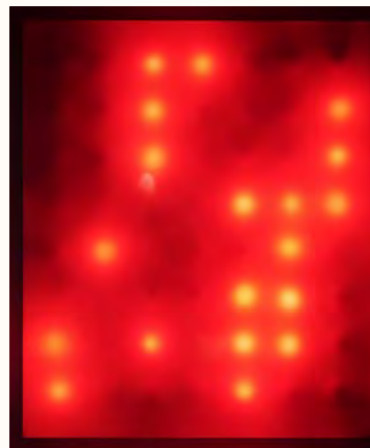
While it may be obvious to most viewers that the flashing lights in Villareal's most iconic works—like *The Bay Lights* (2013), an installation of 25,000 LEDs that form abstract patterns on the bridge connecting San Francisco to Oakland, or *Multiverse* (2008), a sparkling underground concourse linking the buildings of the National Gallery of Art in Washington, D.C.— are somehow controlled by computation, it's less apparent that these are generative works. Villareal's light installations express algorithms that he modulates through intensive site-specific experimentation that creates a final effect integrated into its environment.

Technology is a part of our environment. Cables wrap around the globe and satellites circle, all attending to our needs. Culture is not distinct from nature but made up of it and through it. In situating technological sculptures in public places, Villareal heeds art historical precedents, painters like Turner and Whistler who achieved a mastery of color and light by immersing themselves in the landscapes they painted. Whistler spent forty years engaged with the Thames and depicted the variety of ships and personages encountered along it in etchings and paintings. The French poet and art critic Charles Baudelaire wrote that Whistler's works were a "...a marvelous tangle of rigging, yardarms and rope; a chaos of fog, furnaces and gushing smoke; the profound and complicated poetry of a vast capital."[5] When designing *Illuminated River* (2019/2021), an installation of undulating light beneath every bridge crossing the Thames, Villareal would walk along the bank, speaking to locals to gain a sense of the river's physical and social flow. He adopted soft hues for his installation and put the lights under the bridges to limit light pollution. A network of concerns becomes apparent in every Villareal work.

Now Villareal has produced *Cosmic Reef* for Art Blocks, an NFT platform dedicated to generative art. The increased interest in generative art brought about by the NFT market offers Villareal an opportunity to foreground this aspect of his practice. The patterns in *Cosmic Reef* evoke nebulous molecular structures as much as the radial symmetry of crystals. Some are reminiscent of chrysanthemums and disco balls, sparkling water and star systems, but only briefly before they transition into other forms. Unlike the looping of many other generative projects, *Cosmic Reef* consists of live simulations without end. This is a recurring trait in Villareal's work because he aims to resist the insistent repetition of a media culture driven by advertisements.[6] It's a conscious effort in *Cosmic Reef* to provide a different kind of experience from our typical encounter with a light-emitting screen. Sitting with the shifting nebulae induces meditations on complex webs of associations—the similarities of computer algorithms and biological patterning, the uto-

pian possibilities enabled by electric machinery, and the environmental damage wrought by their energy consumption. To see *Cosmic Reef* as a set of pretty animations would be like looking at the work of Turner and Whistler as charming impressionistic paintings rather than scenes that capture the effects of industrial pollution, social storms, and political uncertainty.

Prior to the release of *Cosmic Reef,* I spoke to Villareal about the process of developing the work. The custom code for *Cosmic Reef* includes multiple layers, each of which have their own color palettes. The proliferating layers created visual chaos, especially when randomized. To ensure a sense of unity, Villareal worked with his team of engineers and coders to develop a method of producing gradients. It coheres the palette for the 1,024 visual outputs minted through the Art Blocks system. The artist's use of color has a painterly care that is matched by his attention to the underlying software.

Shadows and negative space ensure a sense of volume across the iterations of *Cosmic Reef.* Villareal used Three.js, a JavaScript library that renders 2D and 3D images in a browser. Three dimensionality is evident in Villareal's sculptural approach to light, so it makes sense that he sought out a software that could reproduce the dynamics of his physical works for a web-based experience. Villareal describes sifting through the hundreds of presets while making *Cosmic Reef,* many of which contained 100 variables each, in order to find what worked when layered together. To a simple shape like a sphere or torus he would add variations—changing resolutions, moving elements, introducing noise or feedback in layer upon layer—in order to discover exciting moments within the networks of possibility. The final visual abstraction is paralleled by technological abstraction we do not see.

← THE BAY LIGHTS
2013
Site-specific installation: The Bay Bridge, San Francisco, CA
LEDs, custom software
1.8 miles wide × 525 feet high

Villareal introduced movement to the parameters guiding the core shape by coding a telescopic effect for each layer. The feeling of zooming in and out from foreground to background and back again is almost cinematic. The change in focal length in a camera lens mimics what the eye can do and contributes to the physicality that is so important to viewing Villareal's sculptures. To present *Cosmic Reef* as a sculptural object, he made it possible to press the letter Z on a keyboard as a means of activating a journey, allowing audiences to navigate in and out of the space of the artwork.

Known for his public artworks, Villareal approaches blockchain as another kind of commons. Its decentralized and distributed architecture produces a kind of community, not only through the Discord chats or associative tagging that digital art encourages, but also as an infrastructure produced by all the computer and human participants. He had been following the developments and creative exploration of this emergent technology for several years but remained uncertain about working under the limitations inherent to a flat screen. Finding the software tools that matched his sculpture practice helped him decide to produce a blockchain-based project, and when he met the Art Blocks team he found the right niche for his work.

↑
LINE
2012
Site-specific installation: MoMA PS1, Long Island City, NY
LEDs, custom software, and electrical hardware
210 inches
Unique

Cosmic Reef was released as a part of Art Blocks' curated collection, which features projects that introduce technological and aesthetic innovations. Villareal comes from the contemporary art mainstream, and on Art Blocks his project stands alongside those of artists better known to the creative coding community. It represents a merging of worlds, communities united through a common practice rather than a shared ideology. Nevertheless, Villareal's longstanding environmental concerns are reflected in Art Blocks' decision to make carbon offsets beyond the emissions associated with the minting of the NFTs. On Art Blocks, *Cosmic Reef* truly highlights the material ties between the virtual and the tangible, between the concrete and the abstract.

Cosmic Reef's emergent formations dispense with illustrations of technology and representations of physical reality. His works make a kind of meditative sense that becomes mundane when narrated in terms of computational biology, the metaphysical, or personal experience. Despite the months of creative effort that went into *Cosmic Reef,* Villareal was never concerned that he wouldn't know exactly how each NFT would appear once minted. "Right now, it's important to emphasize that inherent unpredictability is a feature of both real world and game world realities," he told me.[7] A NFT is at heart a smart contract, which can automate certain outcomes based on determined inputs. But *Cosmic Reef* features the unpredictable through its generative design. Generative art deals in the infinite possibilities of computer programming that some have described as a computational sublime.[8]

The Enlightenment-era philosopher Immanuel Kant presented the sublime as an encounter with infinite greatness, that which can't be measured, parsed, or imitated. The mathematically sublime can be contrived symbolically but not through the senses, while the dynamically sublime is a confrontation with the incomprehensible capacity of nature. Conceptually and tangibly, the sublime awes because it cannot be defined or identified, contained or controlled. It is not representative and in that sense it is connected to abstraction. The experience of the sublime is indexical in that it points at something we can neither hold nor truly fathom. The inability to manage the sublime produces both pleasure and fear. Recognition that there are things more vast and powerful than we can comprehend is ecstatic and also terrifying. Generative systems' ability to produce an astronomical variety of exemplars is astounding. They deliver an encounter with that which is otherwise impossible to imagine.
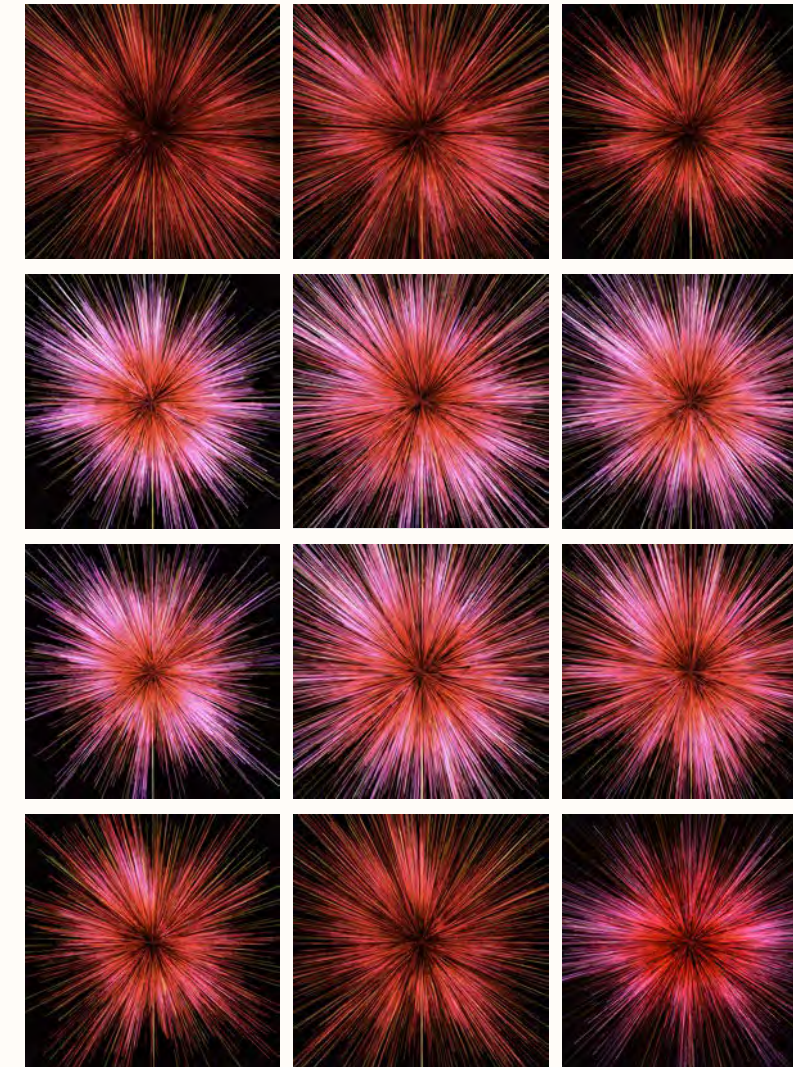
The tension between the programmatic and the unexpected revealed by these systems may at first seem alien but becomes quickly familiar. "I think somehow, these very mechanical means are able to create things that we're very connected to as humans, things that we respond to in nature: this sense of wonder or sublime," Villareal said.[9] There is great pleasure in standing before something we can't quite sum up. This is why art often eludes description and yet pulls at us to find the words. Art and technology are abstract and abstracted spaces through which to meditate on our assorted changing relations with the world around us.

Cosmic Reef invokes natural systems in the title and the works may look like far-flung nebulae, but the series also provides a means to reflect on the role of abstraction in the contemporary. It offers a way to think through the abstraction of our digital environment, which is crucial to understanding the structures rising around us. Of course, it is possible to admire generative art like *Cosmic Reef* without thinking about what the abstractions of digital capitalism have generated—social stratification and space exploration, species collapse and information wars. Generative art is a visualization of code so a society coalescing around the possibilities of coded permutations ought to appreciate that particular practice. Villareal's title urges us to reflect deeply on the material ties between the virtual and the tangible, for those are not abstract concerns. The future depends on recognizing them as interrelated, the rules and parameters of one layer influencing the possibilities of the next. •

NOTES

Portions of this essay are adapted from the author's review "Layers of Light," *Outland,* Jan. 24, 2022. outland.art

1 Jack Burnham. *Beyond Modern Sculpture: The Effects of Science and Technology on the Sculpture of This Century.* New York: George Brazille, Inc, 1969, 3–4.

2 Ibid., 5.

3 Interview with the artist, Jan. 17, 2022, and Varick Shute, "Sequence of Light: A Conversation with Leo Villareal," *Urban Omnibus,* Oct. 24, 2012. urbanomnibus.net

4 Alfred H. Barr. *Cubism and Abstract Art: Painting, Sculpture, Constructions, Photography, Architecture, Industrial Art, Theatre, Films, Posters, Typography.* Cambridge, Mass.: Belknap Press of Harvard University Press, 1986, 19.
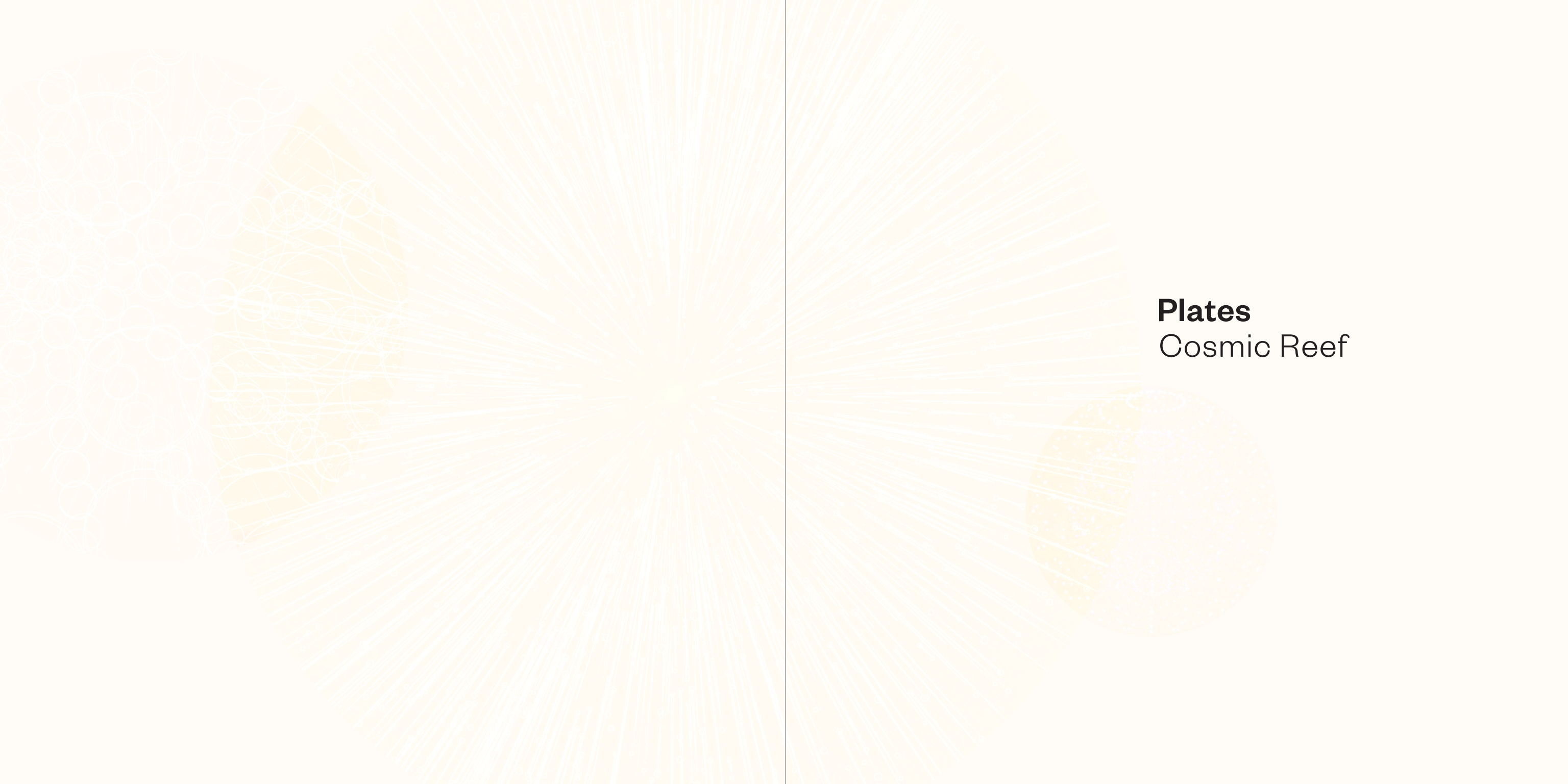
5 Charles Baudelaire. *Art in Paris, 1845–1862, Salons and other Exhibitions.* Ed. and trans. By Jonathan Mayne. London: Phaidon Press Ltd., 1965.

6 Shute.

7 Email from the artist, Jan. 13, 2022.

8 Jon McCormack et al. "Ten Questions Concerning Generative Computer Art." *Leonardo 47,* no. 2 (2014): 135–41, 137.

9 "Superblue Presents Artist Leo Villareal." superblue.com
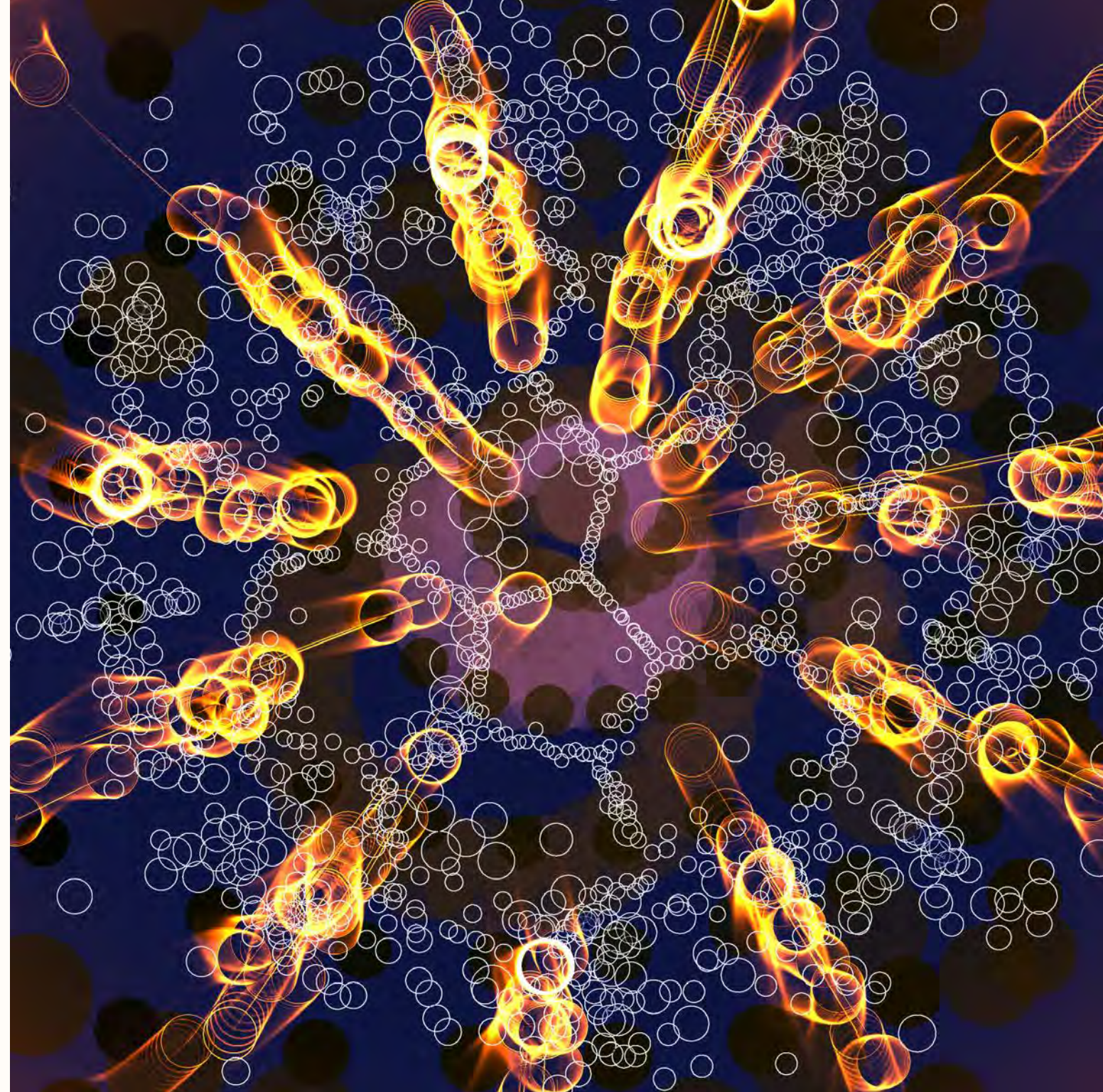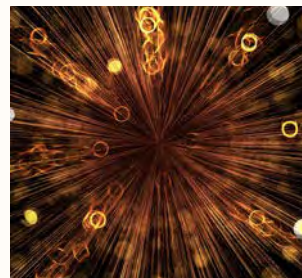
Plates
Cosmic Reef

→
COSMIC REEF #0

2022
interactive media | adaptive resolution
algorithmic edition of 1,024
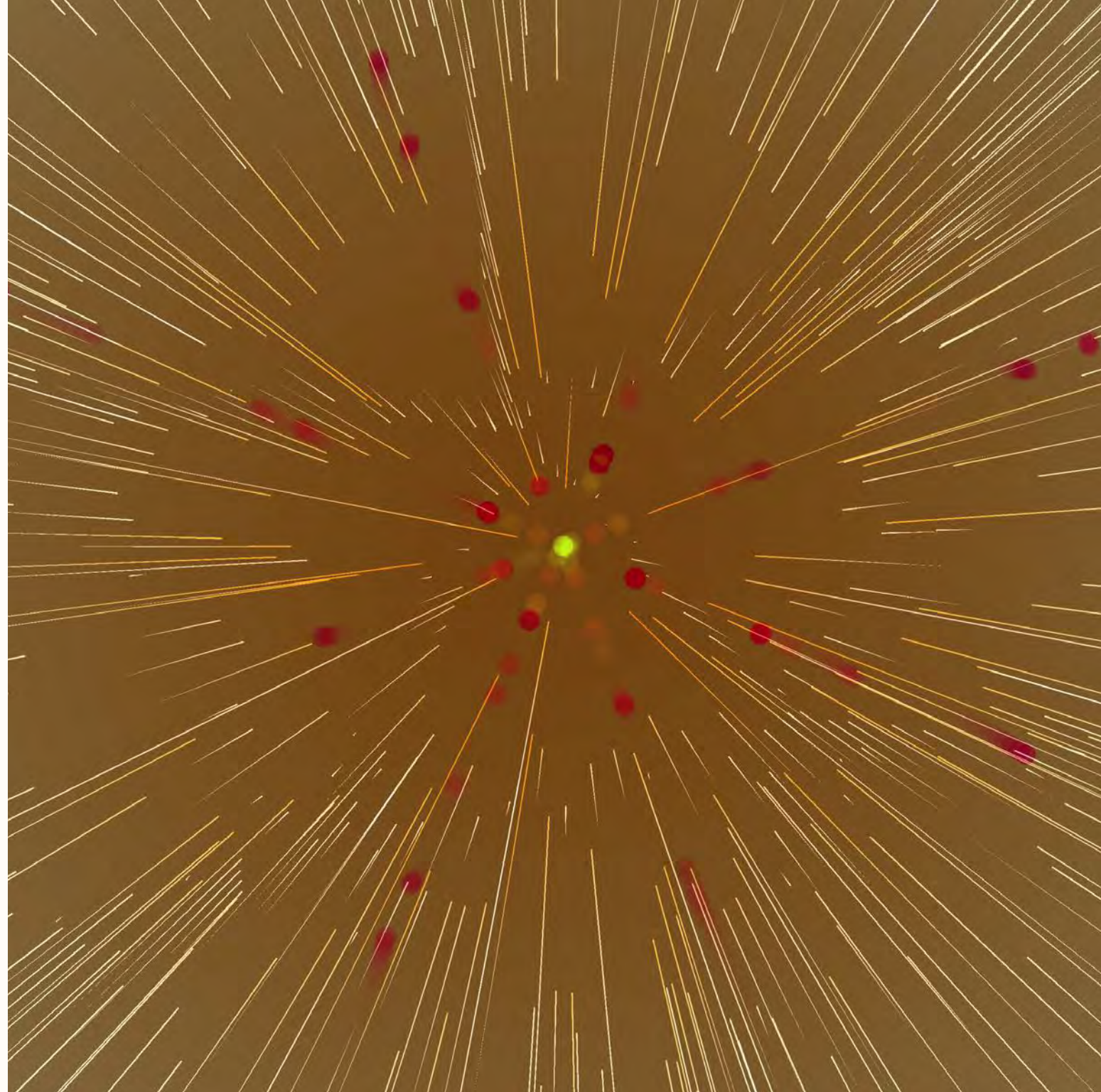*Courtesy of the artist*

←
COSMIC REEF #345
2022
interactive media | adaptive resolution
algorithmic edition of 1,024
Courtesy of pixelpete

→
COSMIC REEF #899
2022
interactive media | adaptive resolution
algorithmic edition of 1,024
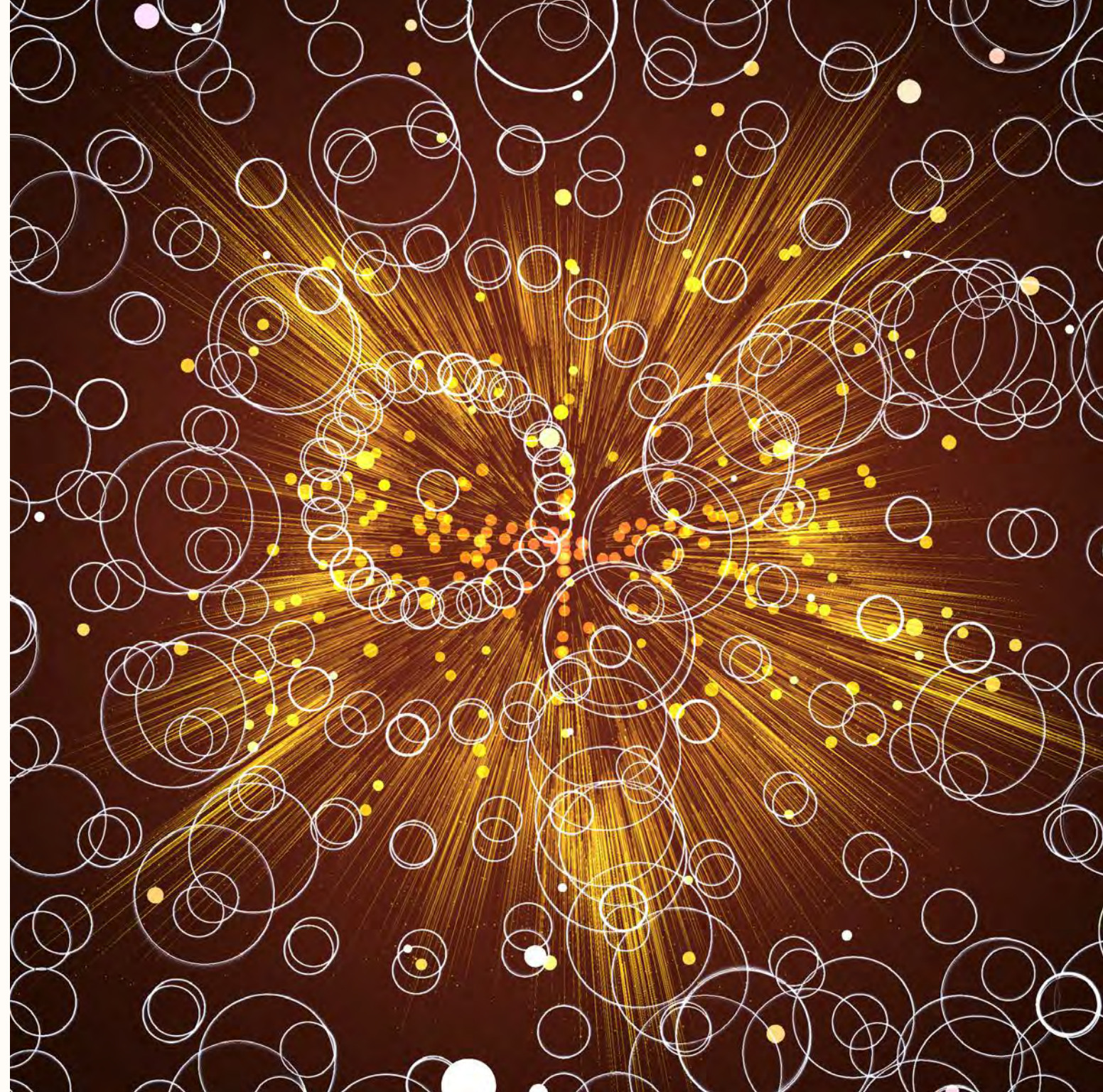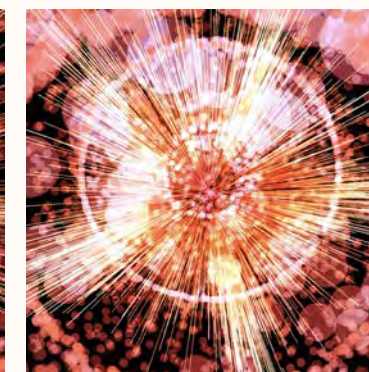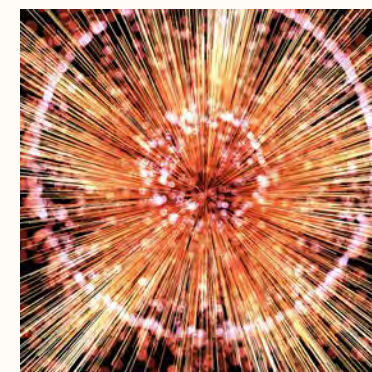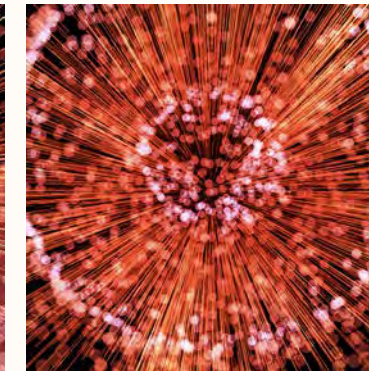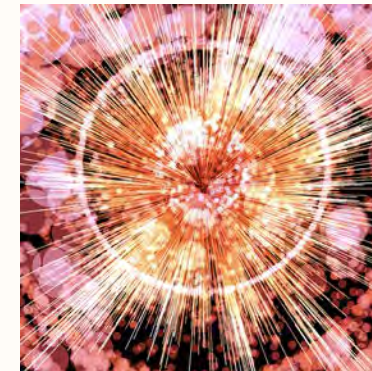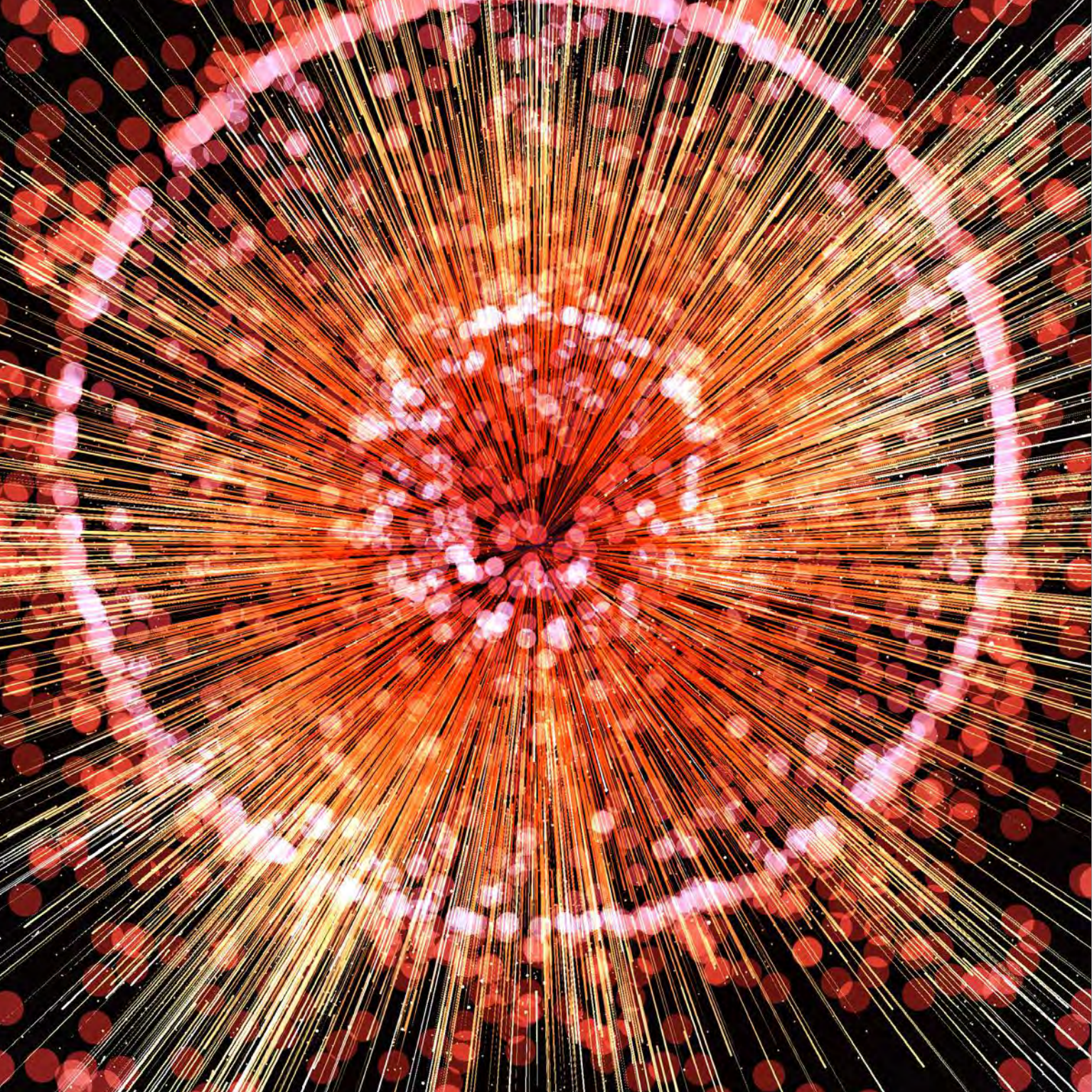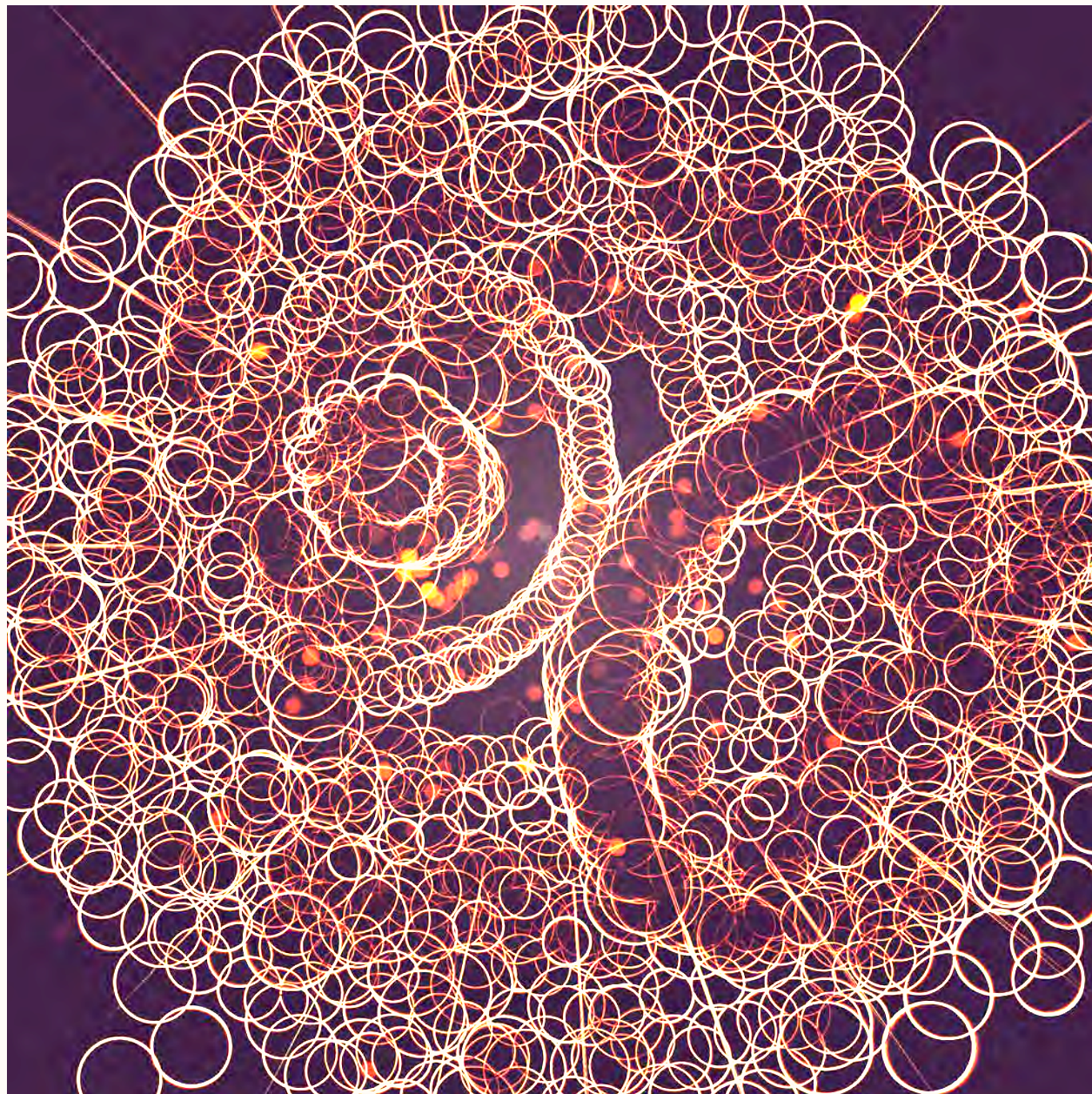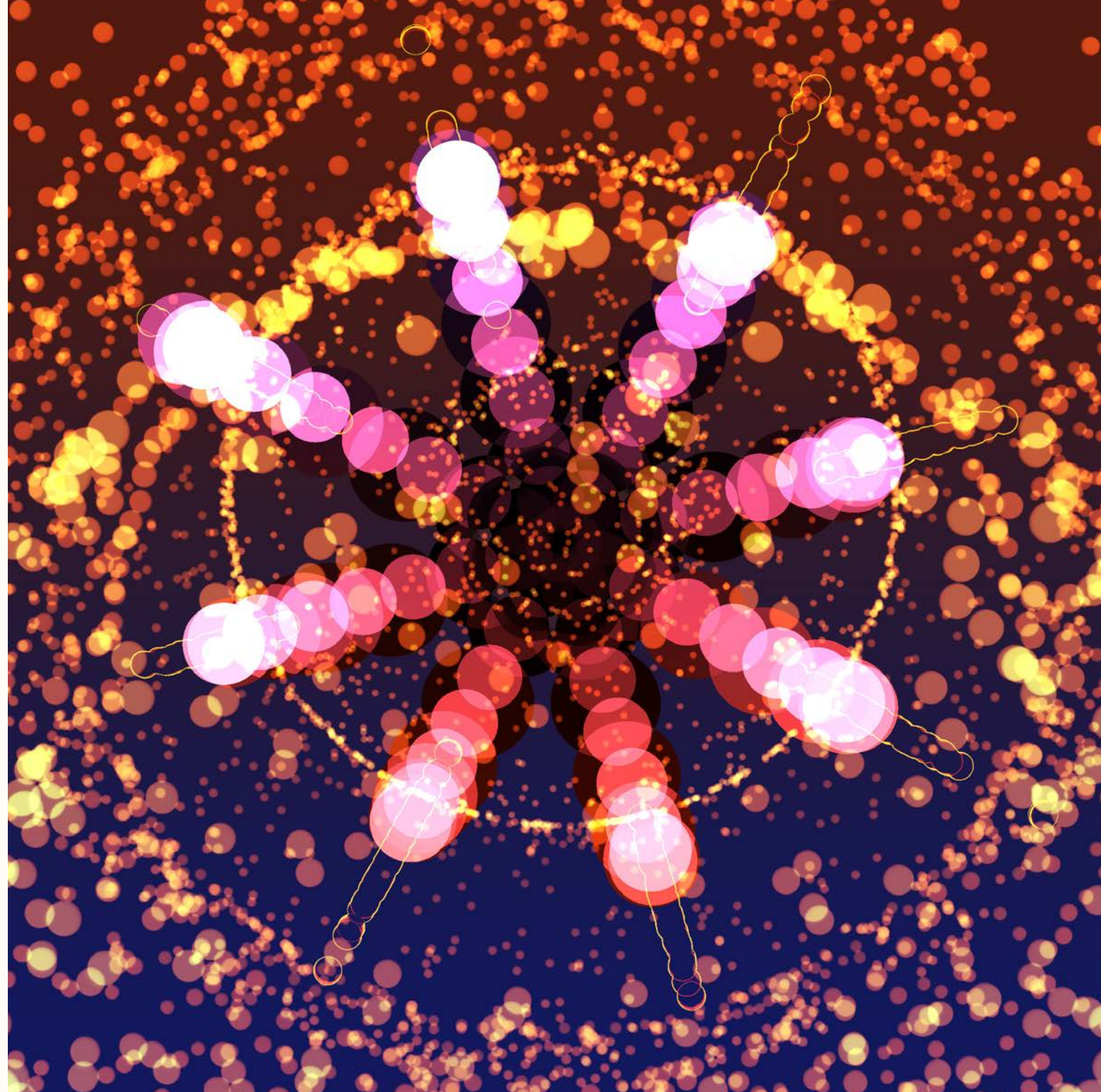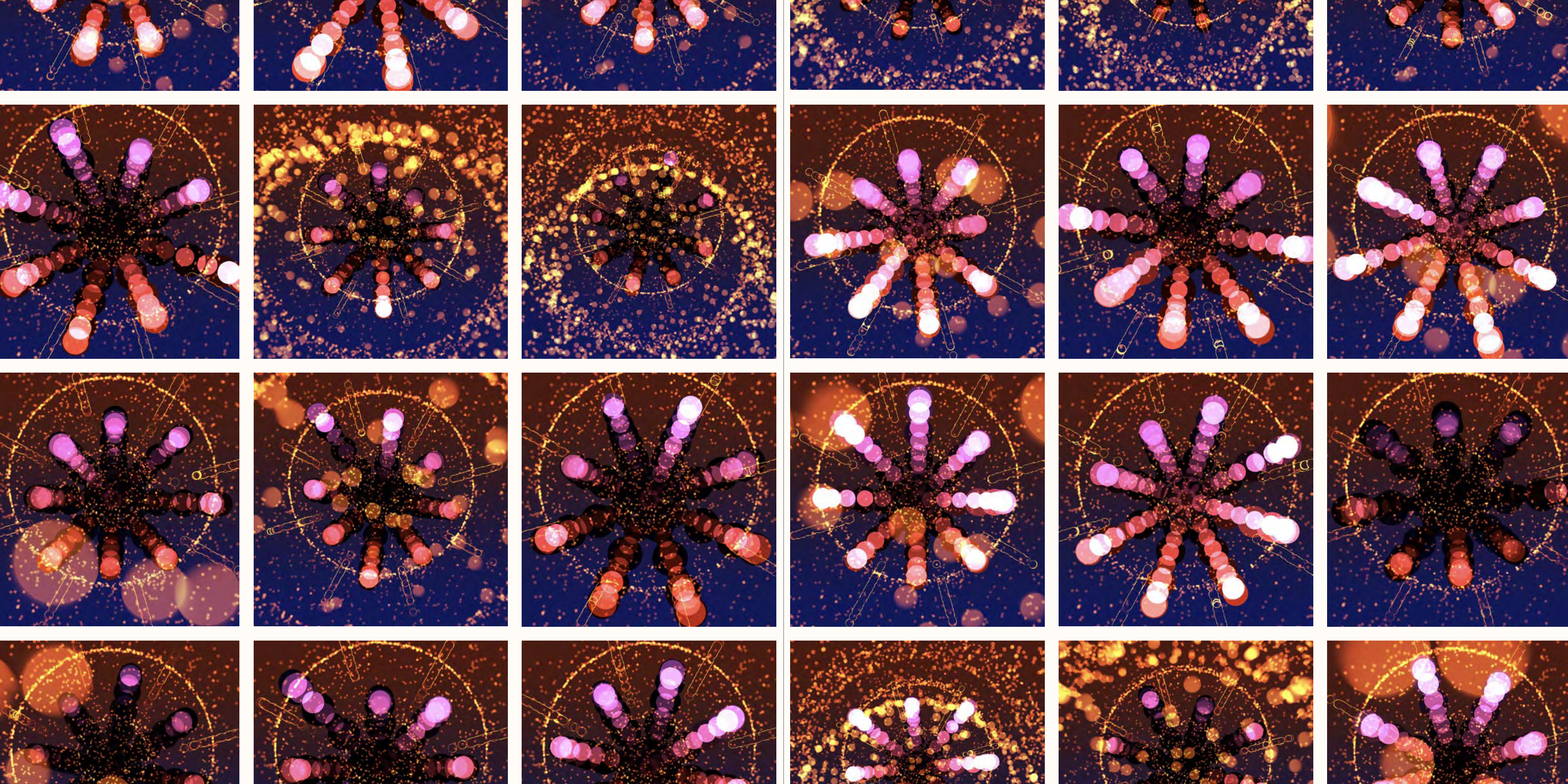*Courtesy of newB*

←
COSMIC REEF #326

2022
interactive media | adaptive resolution
algorithmic edition of 1,024
Courtesy of Zeneca

COSMIC REEF #797

2022
interactive media | adaptive resolution
algorithmic edition of 1,024
Courtesy of Jimbo

COSMIC REEF #79
2022
interactive media | adaptive resolution
algorithmic edition of 1,024
Courtesy of Hodlen Caulfield

←
COSMIC REEF #680

2022
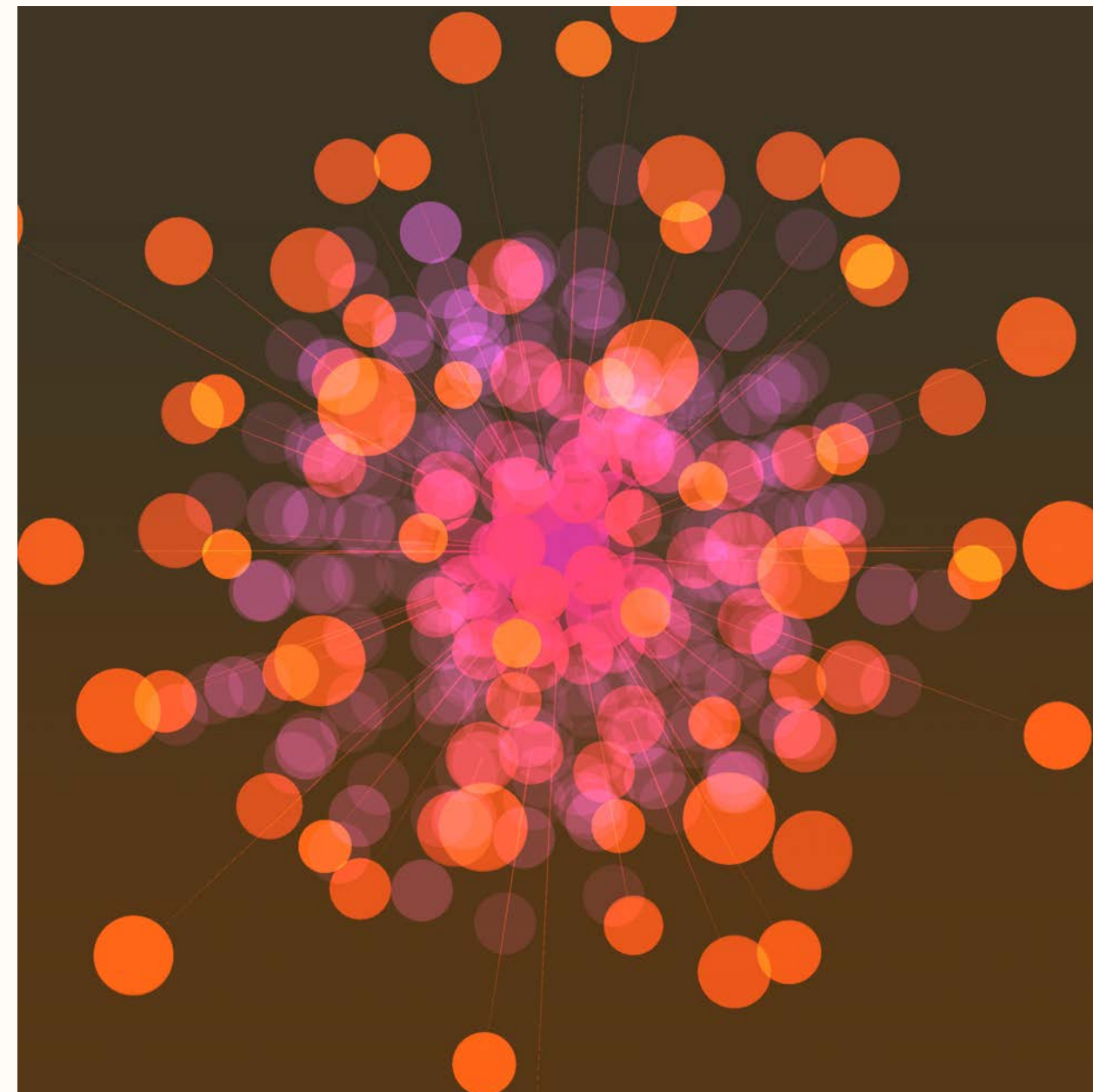interactive media | adaptive resolution
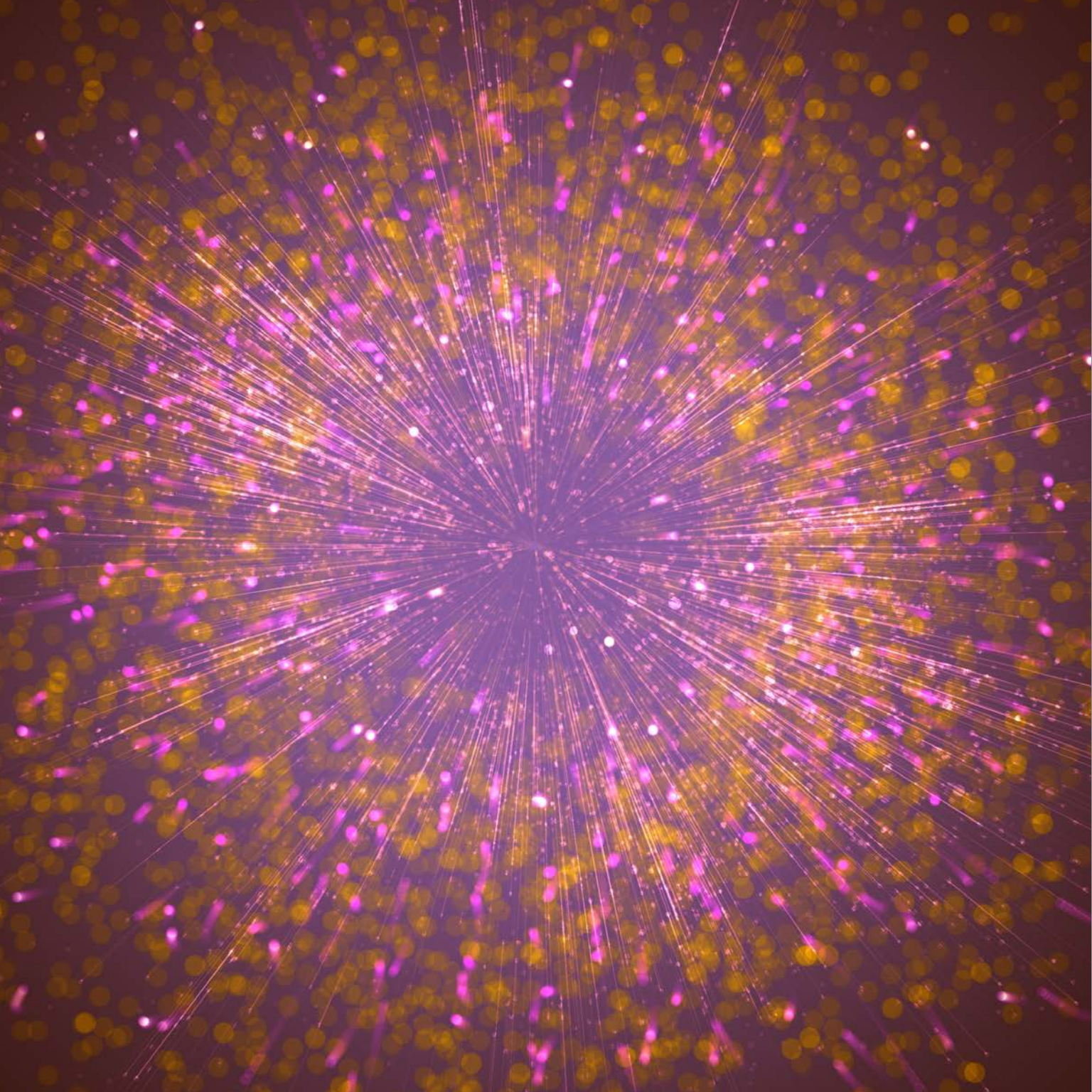algorithmic edition of 1,024
Courtesy of Spencer Neff

→
COSMIC REEF #709

2022
interactive media | adaptive resolution
algorithmic edition of 1,024
Courtesy of ENICOLL

→
COSMIC REEF #958

2022
interactive media | adaptive resolution
algorithmic edition of 1,024
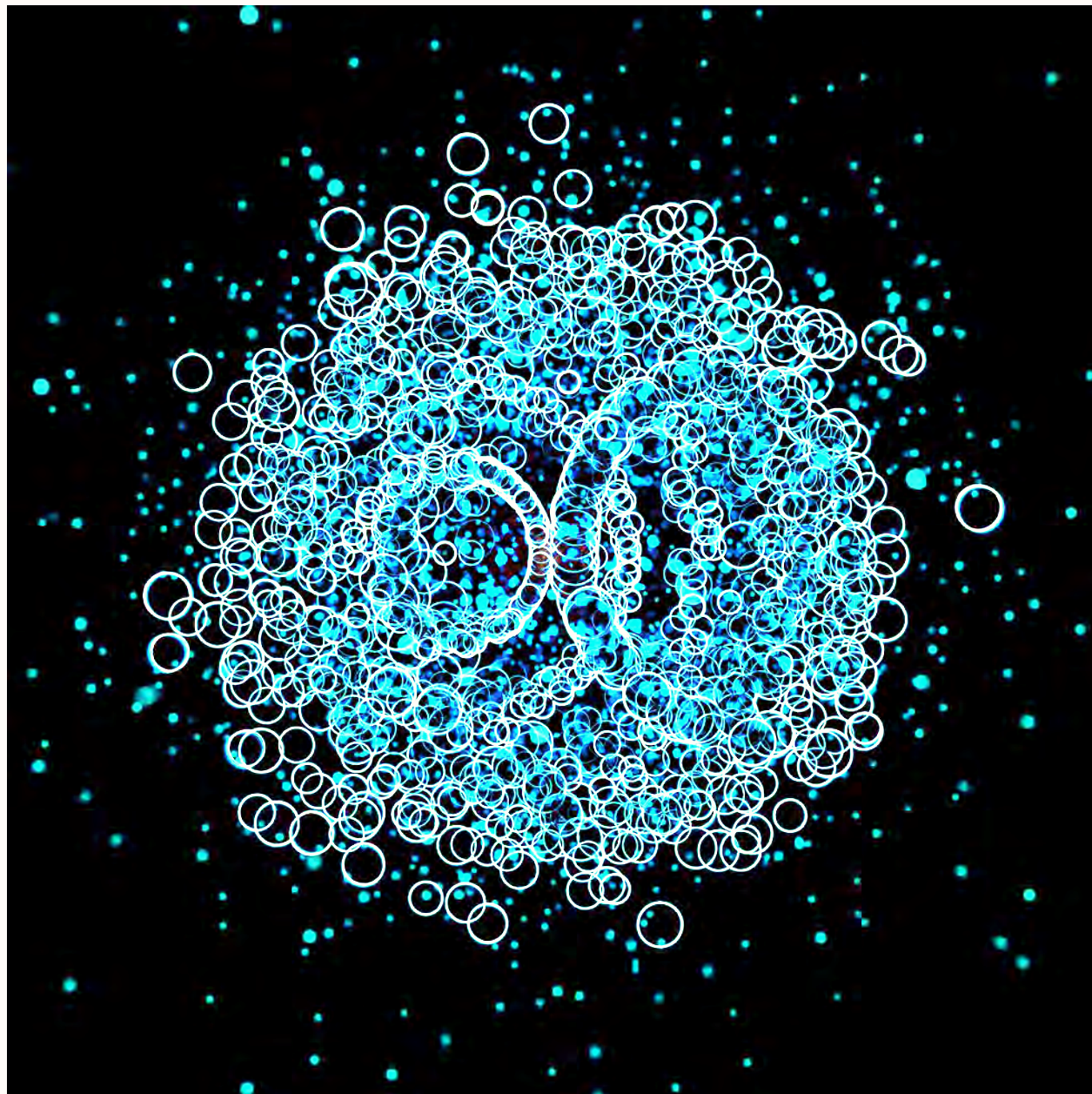*Courtesy of Sebastian Sanchez Collection*

←
COSMIC REEF #254
2022
interactive media | adaptive resolution
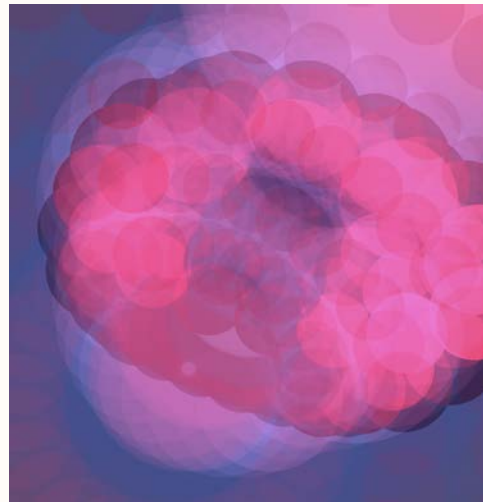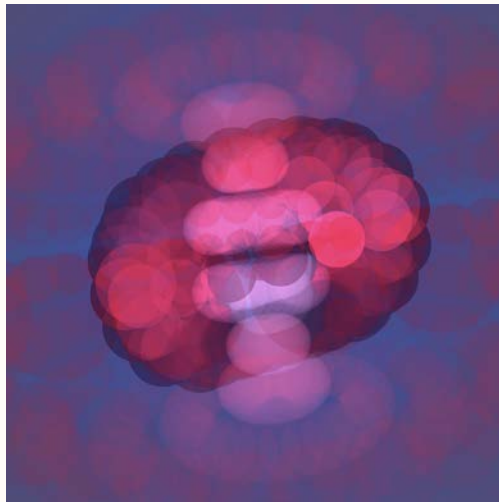algorithmic edition of 1,024
Courtesy of ayybee

←
COSMIC REEF #544

2022
interactive media | adaptive resolution
algorithmic edition of 1,024
Courtesy of Sage

← COSMIC REEF #897

2022

interactive media | adaptive resolution

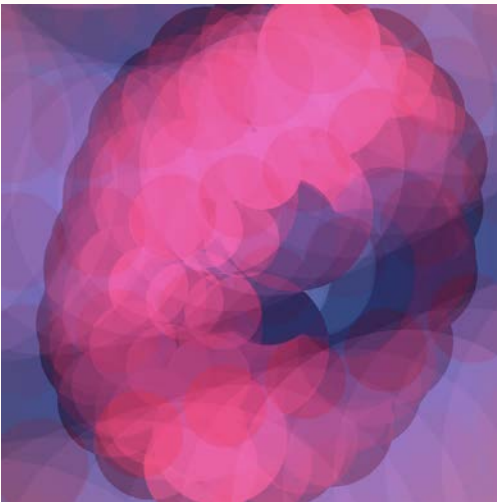algorithmic edition of 1,024
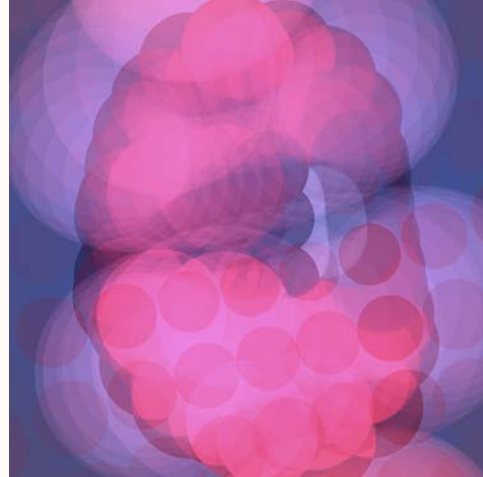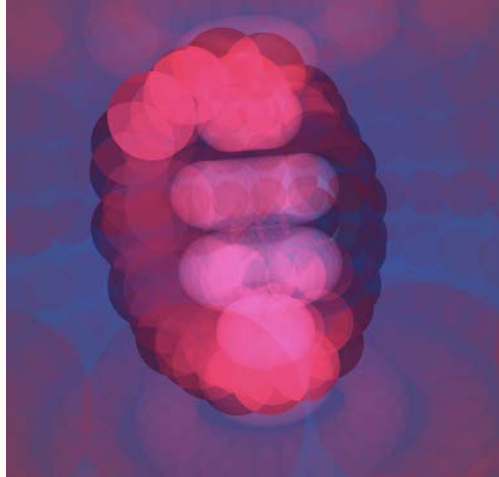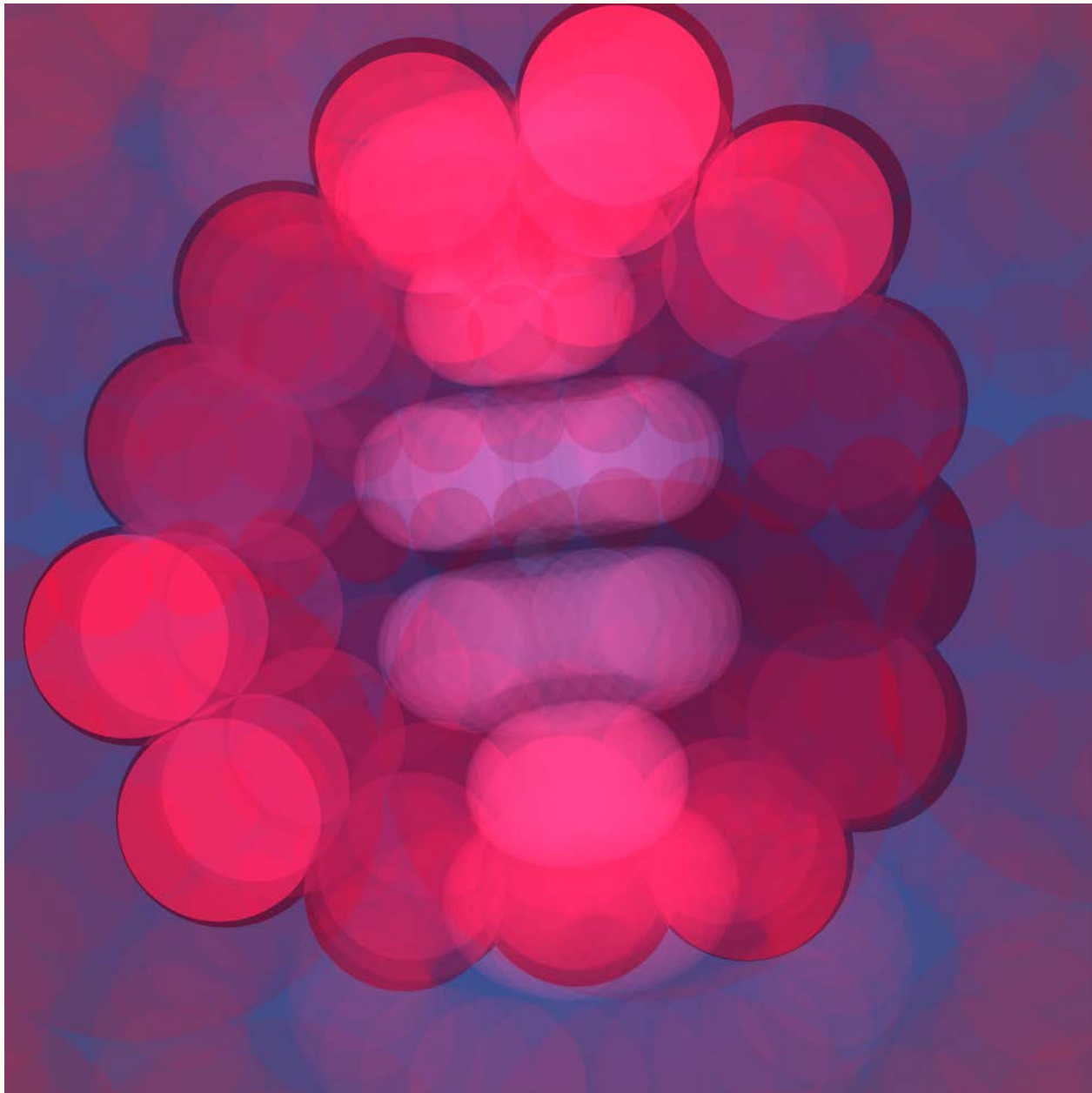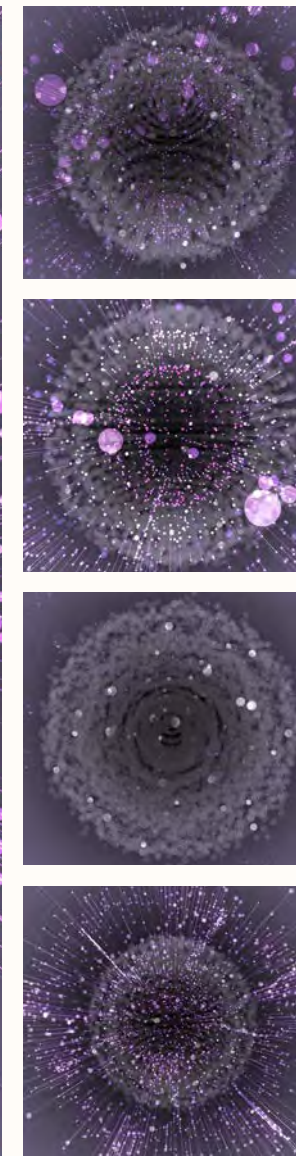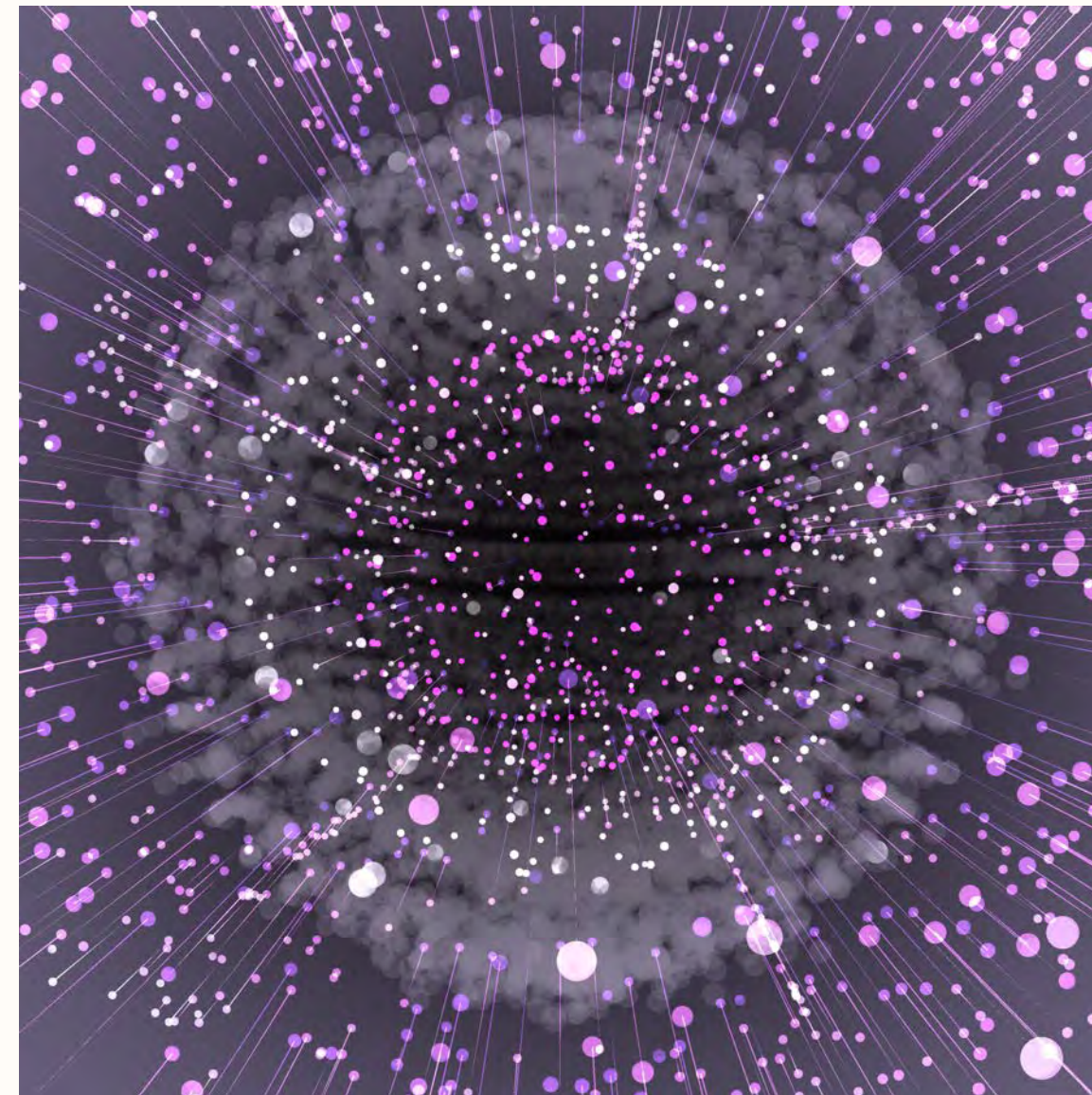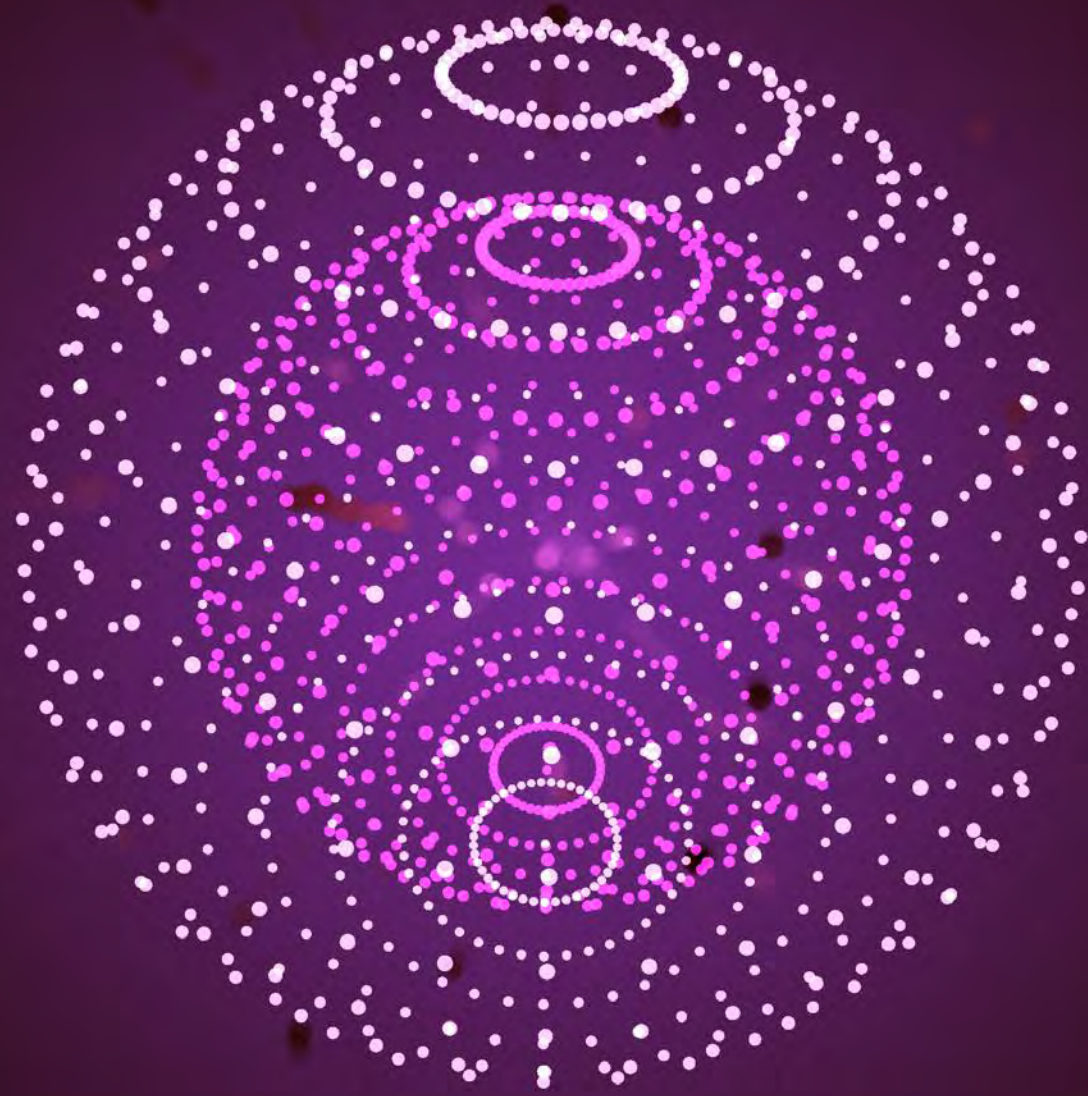
Courtesy of Andrew Badr

→
COSMIC REEF #54

2022

interactive media | adaptive resolution

algorithmic edition of 1,024

Courtesy of Vexxr

←
COSMIC REEF #804
2022
interactive media | adaptive resolution
algorithmic edition of 1,024
Courtesy of fth.eth
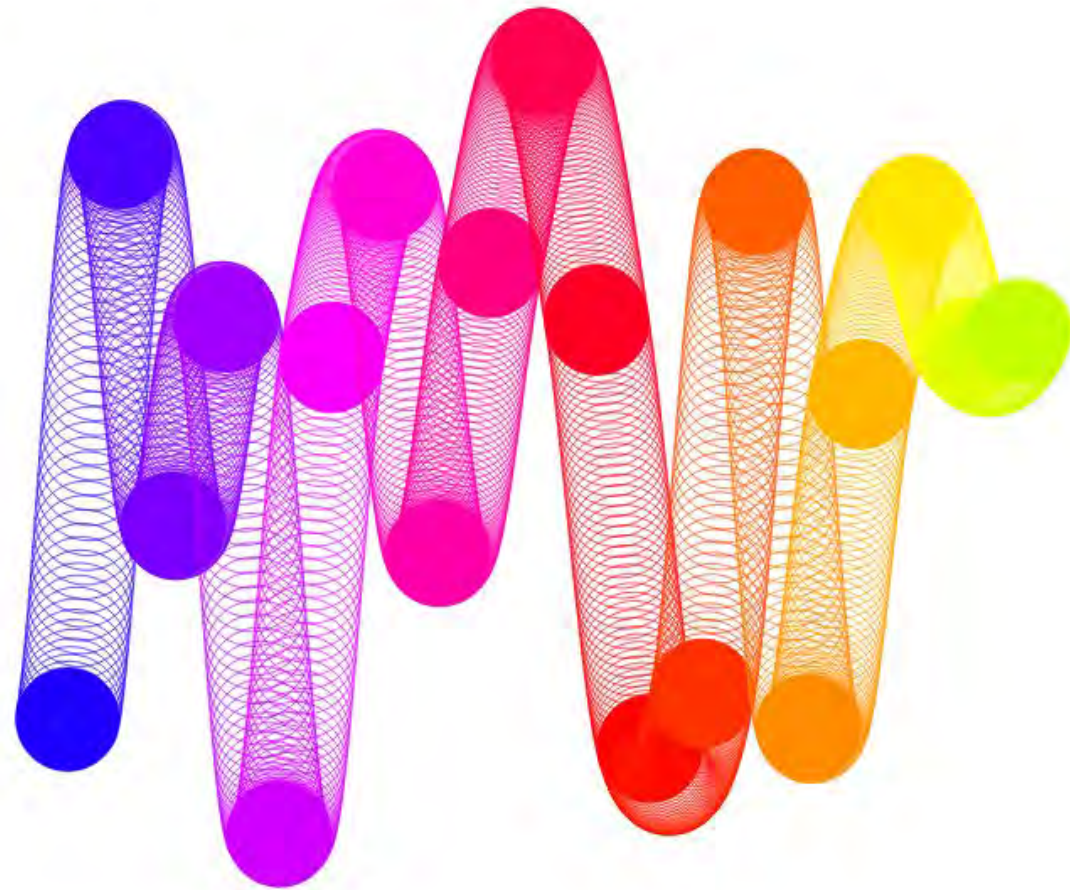
About Art Blocks

Art Blocks is the world's leading platform for generative art, and we're advancing the medium by hosting projects from today's most innovative creative coders. When artists combine their algorithms with blockchain technology, they establish a new paradigm for the creation and ownership of art. Collectors actively participate in realizing an artist's vision by generating unique algorithmic artworks. This symbiotic relationship and shared experience form the basis of our dynamic community.

But before the vision was defined, the community was built, and the art was created, Art Blocks was simply a fun idea born out of a love for technology and generative art.

←
CHROMIE SQUIGGLE #408
Snowfro / Erick Calderon
2019 | digital image | adaptive resolution
algorithmic edition of 10,000

In early 2017 Erick Calderon became obsessed with the immutable and non-fungible nature of the Ethereum Blockchain. In the summer of 2017, Erick read a post on Reddit about CryptoPunks. A pre-ERC721 non-fungible token (NFT) that was free to claim for those motivated enough to set up a fully synced Mist wallet and interact directly with the contract on Etherscan.

CryptoPunks are 10,000 unique (pre)generated 24×24 pixel digital portraits. The collection's rarity was on the developer's website where the rarest CryptoPunks, Aliens and Apes, had been claimed. So Erick decided to find and claim the rarest of the remaining CryptoPunks, and as a result, ended up with 34 Zombie Punks. While he was claiming them, Erick was struck with the idea for Art Blocks.

"Literally, the moment I was claiming my CryptoPunks was when I came up with the idea of Art Blocks. Because I was sitting there thinking, 'Why do I get the privilege of claiming all these Zombies?' The blockchain has enough information and tools for me to click claim and just be presented with a CryptoPunk."

Erick enlisted the brainpower of a few close friends and his brother whereby they would meet every few weeks to flesh out the idea. As his brother Daniel put it, "Erick would come up with idea after idea after idea." Daniel even coded a proof-of-concept project, *Genesis,* that would eventually be released on Art Blocks. Erick's enthusiasm was contagious, but the flurry of ideas, while often leaving others excited, also left them with slight confusion about what it all meant.

Erick was looking for a way to create and share interactive art that personalized experiences. At the heart of it, these ideas were searching for a way to express themselves in a way that connected with a broader audience.

In 2018, Erick hired professional Solidity developers to create the original Art Blocks Smart Contract. At that time, Erick had sold some CryptoPunk Zombies to help fund the development of Art Blocks. And while this helped lay the foundation, the platform wasn't ready for a broad release. So in 2020, after spending his free time developing his Solidity acumen, Erick rewrote the smart contract to fit Art Blocks' unique use case.

Erick also continued to develop his *Chromie Squiggle* project, which he started years earlier while learning to code, into a proper project worthy of uploading to the Ethereum Blockchain. This was his way of testing the limits of generative art. He wanted to do a functionally infinite project. As he emphasized, one should be able to endlessly generate Squiggles and never run into a copy. As he put it:

"*Chromie Squiggle* was the first project. It was a proof of concept. The thought behind *Chromie Squiggle* is, 'what could I create that I could guarantee they were different no matter how many there were?' Adding point data and color variance was a way to do that."
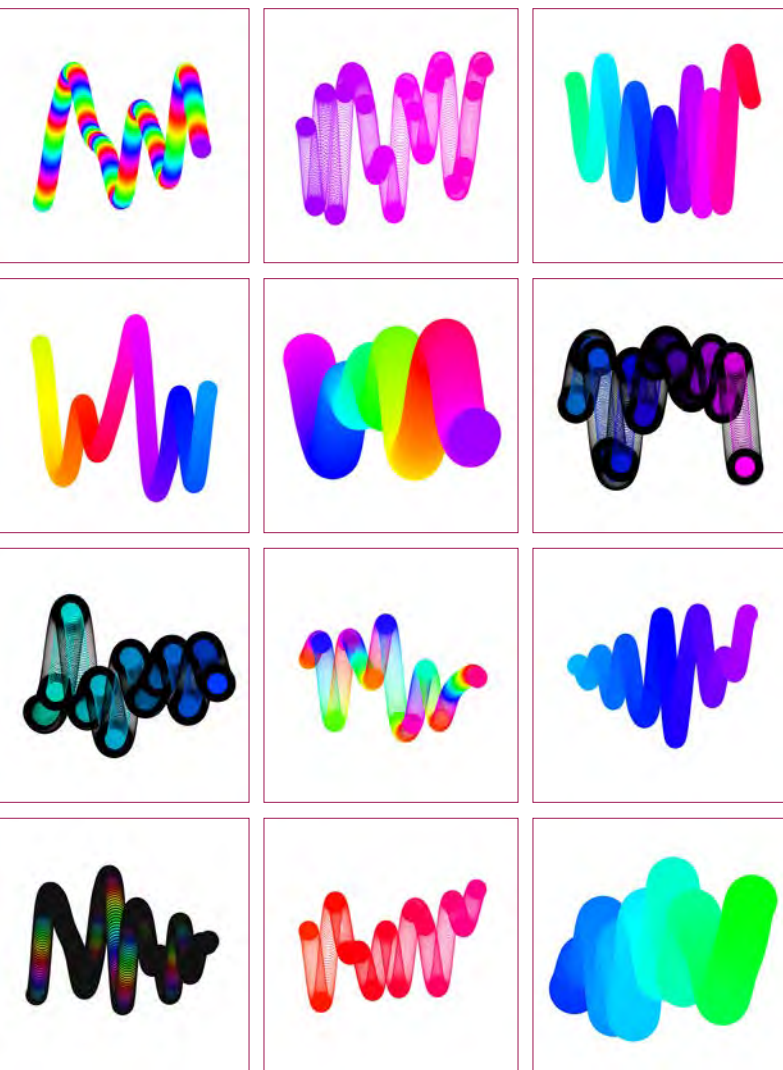
While Erick worked on this phase of the project, Daniel was completing his Master of Fine Arts in Sculpture at the University of Texas and was preparing his grand Thesis Exhibit. Erick asked Daniel if he could polish and deploy the *Genesis* project he created in 2018 as a proof-of-concept in preparation for the launch of Art Blocks.

Lastly, Erick reached out to Jeff Davis. For over two decades, Jeff has been in the art world, running his own print publishing company and working with numerous artists. His journey into generative art began in 2009 when he was using spreadsheets to create novel abstract works. However, it wasn't until 2011 that he learned about Processing and taught himself how to code generative art. Jeff's art would continue to be refined over the years into the distinct style he is known for today on Art Blocks—one distinguished for its vibrant colors, abstract shapes, and melodic patterns.

Although Jeff's background was in traditional art, he was introduced to NFTs in 2019 and decided to go all-in on the next evolution of digital art. He started creating NFTs and sharing the work on social media. Erick had been a fan of Jeff's work and reached out in September 2020 asking him to release a project alongside *Chromie Squiggle* and *Genesis*. Just a month later, Jeff's project *Construction Token* was ready.

The first three projects were ready to be released on the platform, and Erick had assembled a team that brought something unique to the table. Erick had the vision for Art Blocks and an entrepreneurial drive to build the platform. Daniel brought an academic art background, while Jeff was steeped in both the traditional and digital art worlds.

On Thanksgiving night, Erick messaged Jeff and said Art Blocks was going live the next day. Together Erick, Daniel, and Jeff officially released their projects on November 27, 2020. *Chromie Squiggle* has a project size of 10,000, with the first 9,000 available for anyone to mint. The first 9,000 were sold in a few weeks. Daniel's *Genesis* project had 512 pieces. It sold out in just four hours. Jeff's *Construction Token* had 500 pieces, and it sold out in just two hours!

Erick didn't expect Art Blocks to connect the fine art, crypto, and creative coding communities so quickly, but in just a few short months, Art Blocks established itself as a blue-chip art house collaborating with some of the most innovative generative art talents across the world. Artists who Erick followed for years on social media and other platforms (and who he personally considered celebrities) started reaching out to him. They understood the power of the platform and wanted to work with Art Blocks.

The story of Art Blocks is the result of a lot of hard work and a bit of lucky timing. Generative art fits uniquely in the crypto and NFT movement. While most NFT projects consist of digital media uploaded to a centralized server and a token simply points to a server that could be taken offline at any point—Art Blocks is completely on-chain. As long as a computer can access the internet, it can access the generative script and transaction hash to reproduce the art in its original state, in any resolution, and establish provenance, all of which are supported on the Ethereum Network.

Art Blocks continues to evolve the art practice first investigated by curious pioneers like Herbert Franke, Georg Nees, Frieder Nake, A. Michael Noll, Manfred Mohr, and Vera Molnár. These early artists innovated in the dark while the traditional art world thought of them as a passing novelty. For decades, generative art attracted artists who found themselves talking to a small circle of other enthusiastic artists. Their audience was small but enthralled. Today, their vision is evolving and flourishing.

This history—nestled somewhere between the crypto boom, the historically unappreciated creativity of generative art, and the pot ready to boil over with creative coding talent going unrecognized—is where Art Blocks found its corner of the internet and began to flourish. The platform is a passion project. Our community is filled with brilliant artists, enthusiastic supporters, and loyal collectors. It is why we thought it was fitting to provide generative art a place to thrive. A place to express itself among other nontraditional artists and art forms. A proper spotlight on the beautiful art a few lines of code can create. A place that is welcoming and embraces innovation. And ultimately, a place that establishes Art Blocks as a home for generative art.

Our mission at Art Blocks is to provide creative coders a public canvas on a platform built specifically for their artistic expression. We invite you to join us to discover the next evolution of art together. •

Leo Villareal: Cosmic Reef

Visit **artblocks.io** for more information.