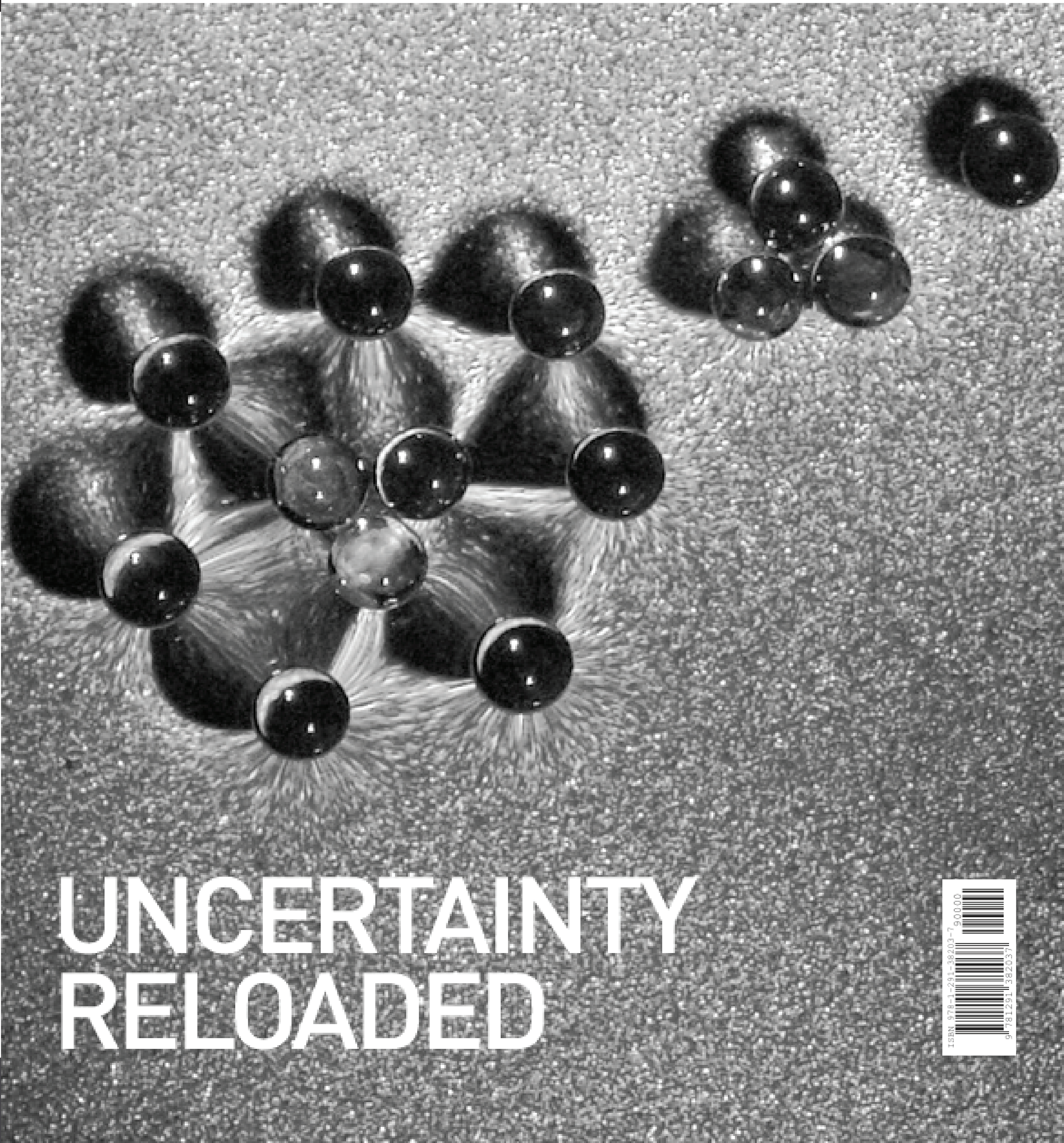
DIGIMAG

the digicult's project journal

74

ISSN: 2037-2256 n° 74 | year VII Winter 2013 Euro 0,00



UNCERTAINTY RELOADED

ISBN 978-1-291-38203-7

DIGIMAG JOURNAL
Issue 74
Winter 2013

Curated by:
Roberta Buani, Marco Mancuso

Editor-in-Chief:
Marco Mancuso

Advisory Board:
Lucrezia Cippitelli, Claudia D'Alonzo, Marco Mancuso, Roberta Buiani

Editing:
Roberta Buiani, Marco Mancuso

Cover:
Evelina Domnitch, Dmitri Gelfand, Mucilaginous Omniverse (2009)

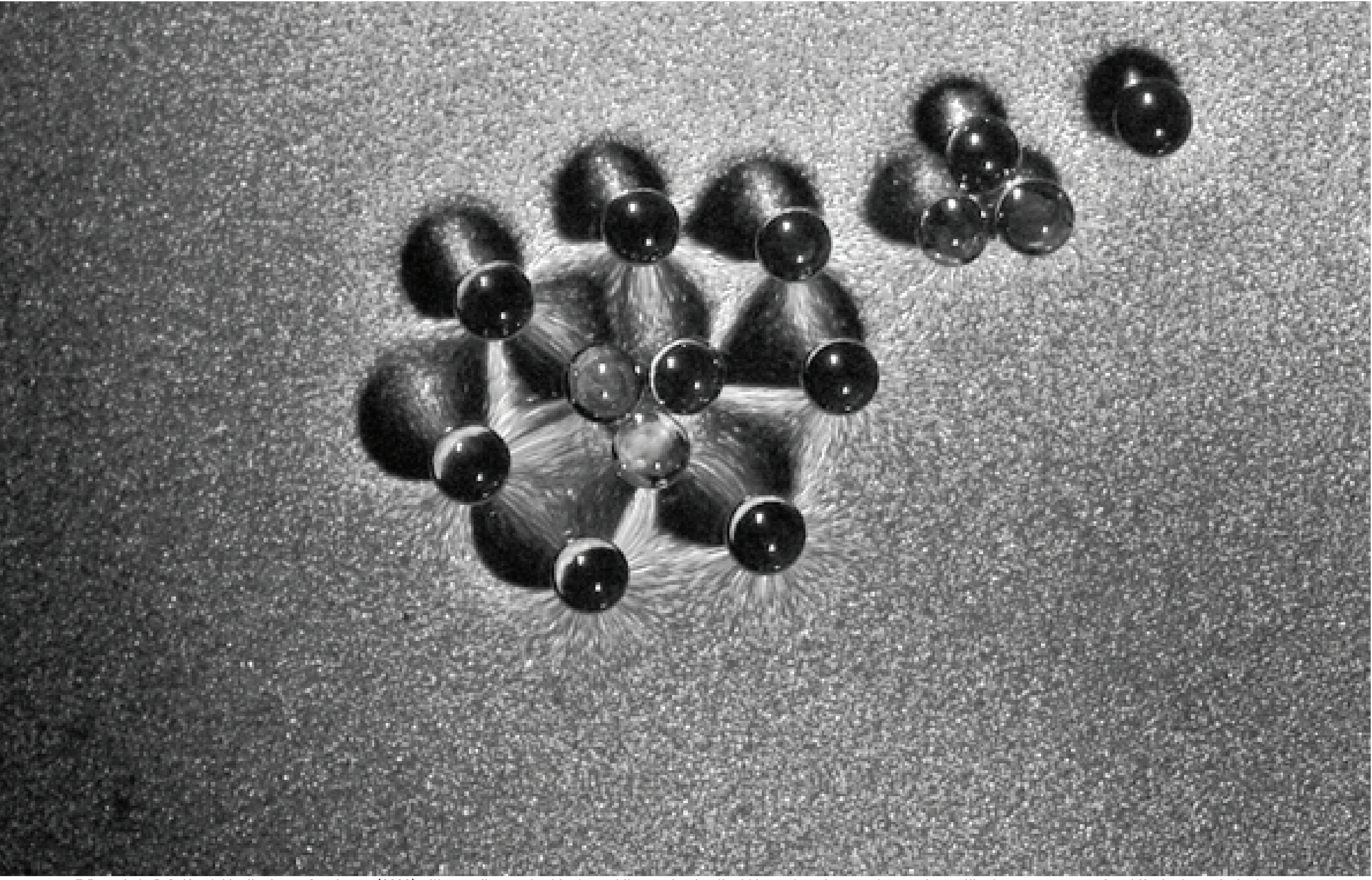
Contributing Authors:
Maria Androulaki, Alessio Chierico, Markéta Dolejšová, Evelina Domnitch, Daphne Dragona, Marc Garrett, Ildiko Meny, Henrique Roscoe, Franco Torriani, Adam Zaretsky

Publisher:
Digicult - Digital Art, Design & Culture
Largo Murani 4, 20133 Milano - http://www.digicult.it
Editorial Press registered at Milan Court, number N°240 of 10/04/06.
ISSN Code: 2037-2256

Printed and distributed by Lulu.com:
ISBN: 978-1-291-38203-7

CONTENT

Digimag Journal 74
Winter 2013



E.Domnitch, D.Gelfand, Mucilaginous Omniverse (2009), silicone oil, sound, white laser. Like a quivering liquid lens, the minutest changes in a cell's shape can account for shifts in the emission's wavelength and amplitude.

HYPERSPECTRAL PERCIPIENCE

Senzienza Iperspettrale

by Evelina Domnitch & Dmitri Gelfand

When only phantom stimuli enter a mind that has been emancipated from external awareness while dreaming or meditating, the distinction between sensory receptors seems to dissolve.

The whole overshadows its parts, fostering a synesthetic perceptual apparatus, far better suited for navigating the subconscious through ambiguous waters. One of Dmitry's earliest discoveries of this apparatus was in the following dream: a field sparkling with insects with which the dreamer comes in tactile contact, and each tingling intersection is charged with a sensation of heat accompanied by a drastic color shift in both the landscape and the sky. Many years later, such sensorial amalgamations began to arise as a consequence of our artistic pursuits along the as yet uncharted divide between quantum and classical behavior. Between the atomic scale and the macroscopic world lies the mesoscopic scale. Any attempt to delineate this mesoscopic tipping point has failed thus far, despite quantum physics' extremely successful predictions of macroscopic instruments' measurements of micro-systems.

One of the reasons for this failure to localize a hypothetical quantum threshold, is that the measuring apparatus always becomes part of the examined system. However, unlike a data-gathering device, an observer is capable of psycho-sensorially coupling with reality, eliminating the need to distinguish between the apparatus and the system. Yet, there is another, deeper quantum slipperiness and ubiquity: entangled "consequences of events in one place propagate to other places faster than the speed of light. This happens in a way that we cannot use for signalling. Nevertheless, it is a gross violation of relativistic causality. [....] It may be that a real synthesis of quantum and relativity theories requires not just technical developments but radical conceptual renewal" [1]. Our first step towards this transformation of awareness was the abandonment of playback and simulation ("signalling") media: the ever-transforming interchange between the observer and a non-virtual mesoscopic phenomenon can never be reproduced or simulated – reduced to a signal. The observer and the observed must emerge simultaneously, in as intimate contact with one another as possible.

Accordingly, our artworks are not complete without being directly experienced, because they strive to alter and renew perception. It is a form of anarchy to leap beyond the settled and well-sieved sensory streams commonly accepted as discrete senses. An example of such a leap would be a perceptual deceleration of the passage of time in order to experience the unmistakable glistening of eternity. This "zero-point temporality" is often accompanied by a sense of interconnectedness, a facet of which is the entanglement of sensory modalities. There is never anything in these artworks that will let the mind slip into familiar troughs of meaning, or anything that can be unequivocally named by everyone. We always try to suspend ourselves and our audience in the most ephemeral and measureless environs that we can "tame". Though without familiar symbolic content, such fluid unfoldings are usually staggering in complexity and multidimensionality and can slightly unveil to a "suspended" mind an exponential avalanche of quantum emergence. At this instant, the expansion of a particular sensory envelope can take place.

In the midst of the quantum revolution in the 1920s, Russian futurist Mikhail Matyushin developed a practice of the "expanded gaze". Among other means, this was achieved by training both peripheral and central vision to function simultaneously with maximal focus. Besides contriving the most effective use of color in painting, architecture and urban planning for new communist cities, he tried to connect the scientific description of color with a synesthetic or synthetic perception of color coupled with hearing, chronoception, as well as vestibular, kinesthetic and tactile apprehension. Although Matyushin was not directly investigating synesthesia, he intuited from his experiments that the expansion of sensory capacities has something to do with cross-modal perception. His close friend and artistic affiliate, Kazimir Malevich, was also working towards the expansion of the sensory palette: in 1916, he made 2 curious drawings: *Sensation of the Electron* and *Sensation of Time*.

The first five years of our collaborative work were absorbed by the experience of reality as waves and fields. Though a seemingly innocent preoccupation, such a pursuit can entail a devastation and reorganization of the entire structure of consciousness. Nonetheless, there is a tremendous payoff: a potential sensorial key to the very depths of humanity's scientific insight. Perhaps, at present, mental functionality and knowledge are advancing much faster than one's senses. Conversely, the capacities of synesthetes and savants have always gleamed on the horizon as a potential step in the evolutionary race of cephalisation, the re-folding of the brain into ever finer and more interconnected fissures.

Our apprehension with customarily imperceptible physical and chemical phenomena has incited us to meticulously modulate and fuse the senses. Because the spatial and temporal signatures of these phenomena are often totally unfamiliar to the observer, only under proper mind-focusing conditions can the senses intuitively fill in one another's perceptual blanks. The observer cannot but rely on a synesthetic *instrumentarium* to navigate through untrodden and rather transient

3-dimensional sensory input. Chronoception, sight, auditory and vestibular sensations seem to comprise a disembodied yet singular self-adjusting antenna, capable of extremely subtle attunement.

For countless hours in unspeakable darkness, chasing a very faint breed of light called sonoluminescence [2], we were exposed to a cryptic language, harboring psychomorphic [3] photon environments [4]. Coupled with brain-wave interference at certain flash cycles, acoustically collapsed bubbles were transformed into a rippling inner cavern of undeterminable dimensions. Since one's invisible body could no longer mark the frontier of the senses, they were permitted to wander beyond the scope of localizability: the sonoluminescent formations became a launch pad for extrasensory modes of experience, evoking biophotonic processes inside of the observer. When an organism ceases to be visible to itself, another kind of multi-eyed night vision continues to transpire between biological cells. The light source beheld by the cells emanates from within their own nuclei (much like sonoluminescence arising at the center of imploding micro-bubbles).

Kasimir Severinovic Malevic - Sensation Of Electron

Only in the world's darkest laboratories, can one catch a glimpse of the nebulous light emitted by all living matter. Millions of times weaker than a firefly's luminescence, the emissions originate within an organism's commonest ingredients, biomolecules "any cell engendered by a living system". Besides light-tight tenebrosity and refrigeration, highly sensitive photon detectors are required for the observation of these 200 - 800 nm light pulsations known as biophotons. Though they were discovered in 1923, only very recently have researchers been able to gather some telltale data thanks to pivotal advancements in sensitometry. The syncopation of spectral signatures alludes to a form of photonic communication between biomolecules characterized by coherence, a phenomenon incited by optical resonance, just as in a laser cavity. Quintessential biological processes such as cell growth and division as well as distress signals are regulated by a coherent photon field, which "can be traced back to DNA as the most likely candidate of working as the main source" [5]. Some daring scientists suggest that biophotons may even mediate consciousness itself.

If it were not for a cell's capacity to detect, tune and respond to another cell's light emissions, the instantaneity of intercellular communication would be unfathomable. In an experiment conducted at Northwestern University by biophysicist Guenter Albrecht Buehler, mammalian tissue cells were affixed to both sides of a sheet of glass. The cells on one side modified their angles of growth more than 45° towards those on the other side of the glass. However, when an infrared filter was inserted into the glass, the cells started growing in haphazard directions. For purposes of fortification, tissues favor an intertwined arrangement of cells, so the glass-divided cells were likely using light to navigate their growth pattern. If so, they must have optical receptors. Despite all the freshly accumulated evidence, the biophotonic mechanism underlying this self-organizing cellular "intelligence" remains predominantly unknown.

How can a cell so finely tune the light under its skin? Like a quivering liquid lens, the minutest changes in a cell's shape can account for shifts in the emission's wavelength and amplitude.

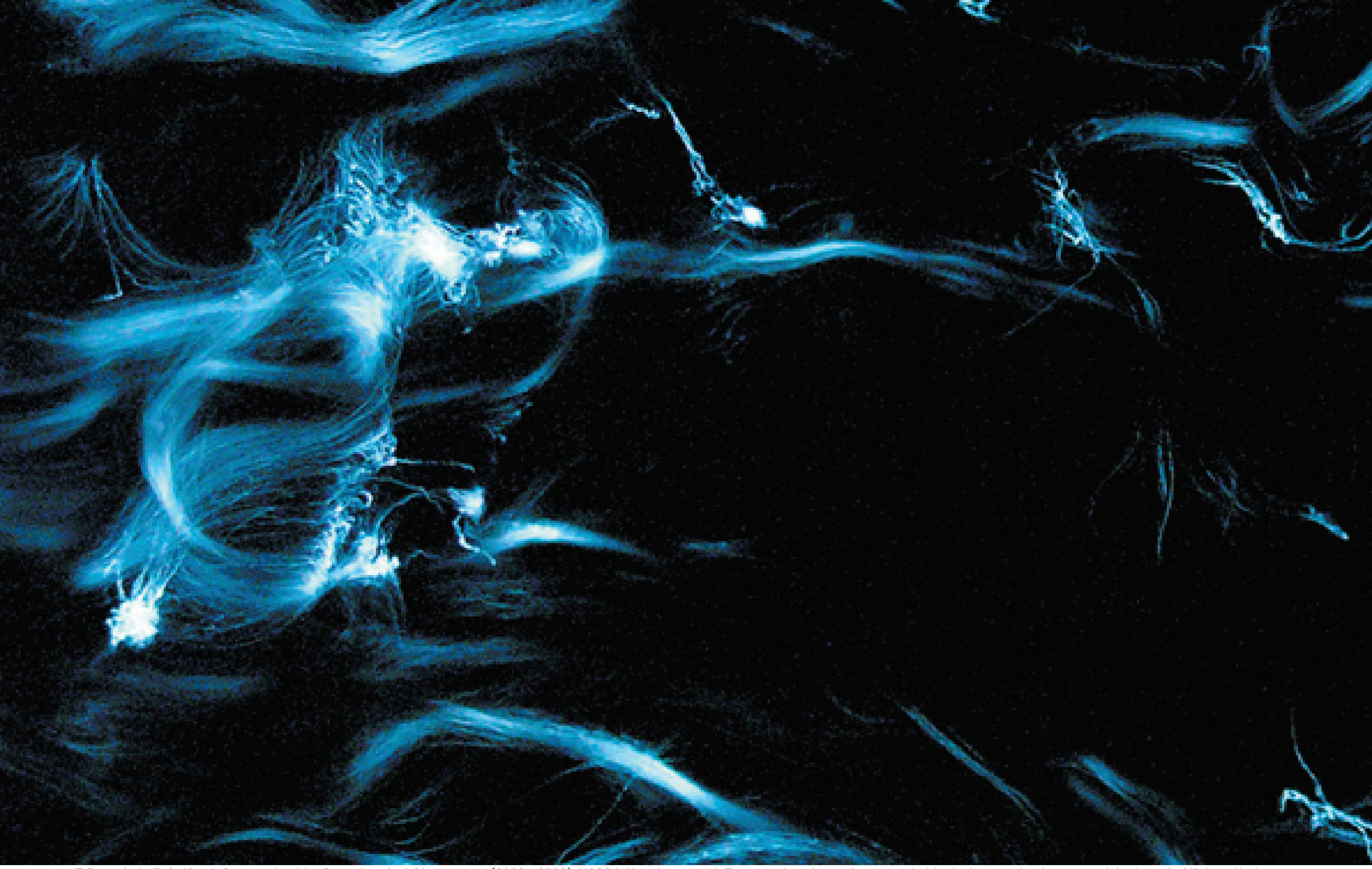
To meet the rapid demands of intercellular communication, precise light field tailoring is crucial. Far simpler than a biological cell, an ordinary droplet of liquid can become an optical resonator when efficaciously reshaped and levitated by a sound field or an ion trap. When the droplet's surface-resonant modes are procured, a laser beam entering the airborne spheroid can switch frequencies and become up to 400 times as powerful" [6]. When laser light penetrates the skin of a soap film "the chemical ancestor of a cell membrane", the beam may divide into microscopic optical tracks that curve along the surface as though ensnared within a wave-guide antenna [7].

The laser channels, which are maneuvered and molded by the mother beam, together behave like "a powerful optical computer with a gigantic parallel processor, consisting of billions of laser-guiding cells" [8]. Light can be swallowed, trapped and potentially harnessed as it dielelectrophoretically re-assembles the molecular contents of its environment: the laser shapes the medium, and the medium synergetically shapes the laser to the point of self-focusing. The fine-tuning of one form of energy/matter by another leads to boundless non-linear possibilities from weightless architecture [9] to "pure-glue hidden valleys through the Higg's portal" [10]. In less than a century, the science of force field tailoring has vastly extended the palette of cosmic ingredients, and encroached on the very limits of conceivable reality. Yet, an empirical translation of this reality requires a force field tailoring of its own.

Artists and adepts have forever tried to manipulate and enrich the palette of the five known senses: vision, hearing, smell, taste and touch. Tedious scientific efforts have revealed a manifold of bodily orifices and molecular networks apprehending the inner and outer dominions. Despite all the invaluable advances in psychophysics, biochemistry, and quantum biology, there is no agreement on the number of human senses. There is also no suitable classification of the senses that will distinguish them according to a single criterion. Some of these newly acknowledged senses include nociception (pain), equilibrioception (balance), proprioception (position) and kinesthesioception (motion), chronoception (time), thermoception, weak magnetoception, and more interoceptive senses are being considered. Although there is no neurological proof of electroception in humans (it is commonest among fish), nearly everyone has experienced contact with electric current, and can unmistakably distinguish it from other stimuli.

The senses long ago acquired a reputation for distorting the "true nature" of reality, and presenting the mind with a mere illusion. Quite on the contrary, sensorial information pilots the entire hovercraft of consciousness. Continuously adjusting to shifting thresholds of perceptibility, sensory mechanisms have been proven to reach infinitesimal levels of elasticity. For example, the human eye can even register an individual photon, although it is conditioned by the brain to suppress all signals below seven photons. Sensory organs and neural networks are feedback instruments, delicately tuned to the most immediate environment, allowing an individual organism to seamlessly fit within the latticework of the biosphere and emergent cognisphere. The latter encompasses transmutations of neuro-sensorial activity into untamable thought patterns that seem to defy all manner of biochemical or metaphysical analysis. Nearly every scientific breakthrough and leap in perception has followed a circuitous yet unrelenting trajectory before finding the last ingredient of the elixir – one that cannot be inferred inductively or otherwise from all available knowledge. "We find ourselves here on the very path taken by Einstein of adapting our modes of perception borrowed from the sensations, to the gradually deepening knowledge of the laws of nature" [11]. Be they "mental pictures" or sensorially contrived experiences, nonverbal thoughts steered the unfolding of scientific creativity.

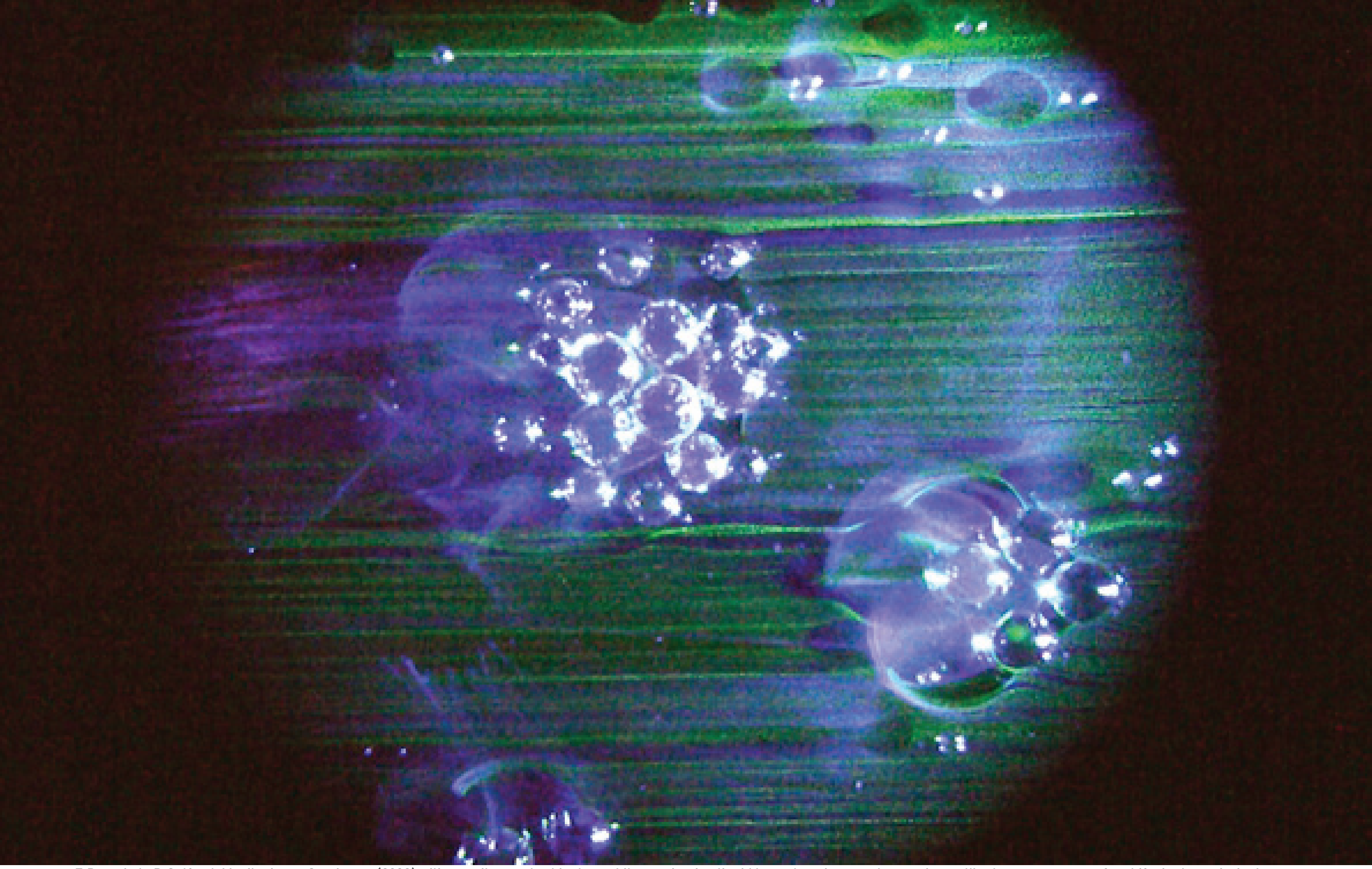
Outside the extravagances of synesthesia, there exist other curious reciprocities between



E.Domnitch, D.Gelfand, Camera Lucida: Sonochemical Observatory (2003 - 2008), H2SO4, Xe, ultrasound. For countless hours in unspeakable darkness, chasing a very faint breed of light called sono-luminescence, we were exposed to a cryptic language, harboring psychomorphic photon environments

different modes of sensation. As light emissions entail magnetic ripples, photosensitivity can be cross-wired with magnetoception. The fancifully named photoreceptor cryptochrome, sensitive to blue and UV light (from 380nm to 450nm), enables magnetoception in insects and avians. In birds' eyes, the activation of cryptochrome may affect the light-sensitivity of retinal neurons, which would permit the 'visibility' of magnetic fields. In what form would they be 'seen' remains a ponderous question. Light excitation leads to cascading electron transfer, during which electron spins are influenced by weak magnetic fields; the spin dynamics activate cryptochrome. Many important cellular processes are driven and controlled by events involving electronic degrees of freedom: from the absorption of photons by a photosynthetic apparatus to electron transfer processes, sustaining the electrochemical membrane potential. Another feedback system initiated by cryptochrome is the sense of time on all its biological scales: from circadian and lunar oscillations to germination and gene clocks. This light modulated protein occurs in all kingdoms of life: plants, bacteria, insects and mammals. For circadian synchronization, humans still use cryptochrome, which regulates the melatonin secretion of the pineal gland. Perhaps, our cryptochrome will be able to fully regain magnetoception, but only in the distant future, considering the serpentine evolution of vision.

A blind poet once praised the "three serpents", ascending from both sides of Iris, the rainbow [12]. The philosopher, Xenophanes (570 - 465 BC) also noted 3 colors in the celestial arc: crimson, yellow and purple. Thanks to Sir Isaac Newton, one presumes that there are seven colors in a rainbow. However, it was not by observation that Newton formulated this idea, but he rather borrowed the number from the Pythagorean octave. As he did not trust his imperfect eyesight, the task to define seven dominant colors was relayed to a younger assistant. Newton was also the first to accurately calculate the colors' different wavelengths, despite his theory of multi-colored corpuscles. With our knowledge of photonic perception and eye architecture having reached the level of artificial retina implants, the latest discoveries are extracted from the nanoscopic confines of DNA. While deciphering the genetics of color-blindness, researchers have found



E.Domnitch, D.Gelfand, Mucilaginous Omniverse (2009), silicone oil, sound, white laser. Like a quivering liquid lens, the minutest changes in a cell's shape can account for shifts in the emission's wavelength and amplitude.

humans with tetrachromatism "the presence of four different types of cones instead of three". Colorblindness "the presence of only two types of color receptors in the eye" is found predominantly among males. It was established that certain mothers of such men have a mutation, leading to tetrachromatism. Tests revealed an immense sensitivity for subtleness of color. One such case was so color sensitive that she was able to distinguish 10 distinct hues while looking at a rainbow. Before these experiments were conducted, it was falsely concluded that the brain 'was wired' to see only 3 colors due to the 3 cone types, however its plasticity allows it "to handle as many channels of information as the eye cares to throw at it" [13].

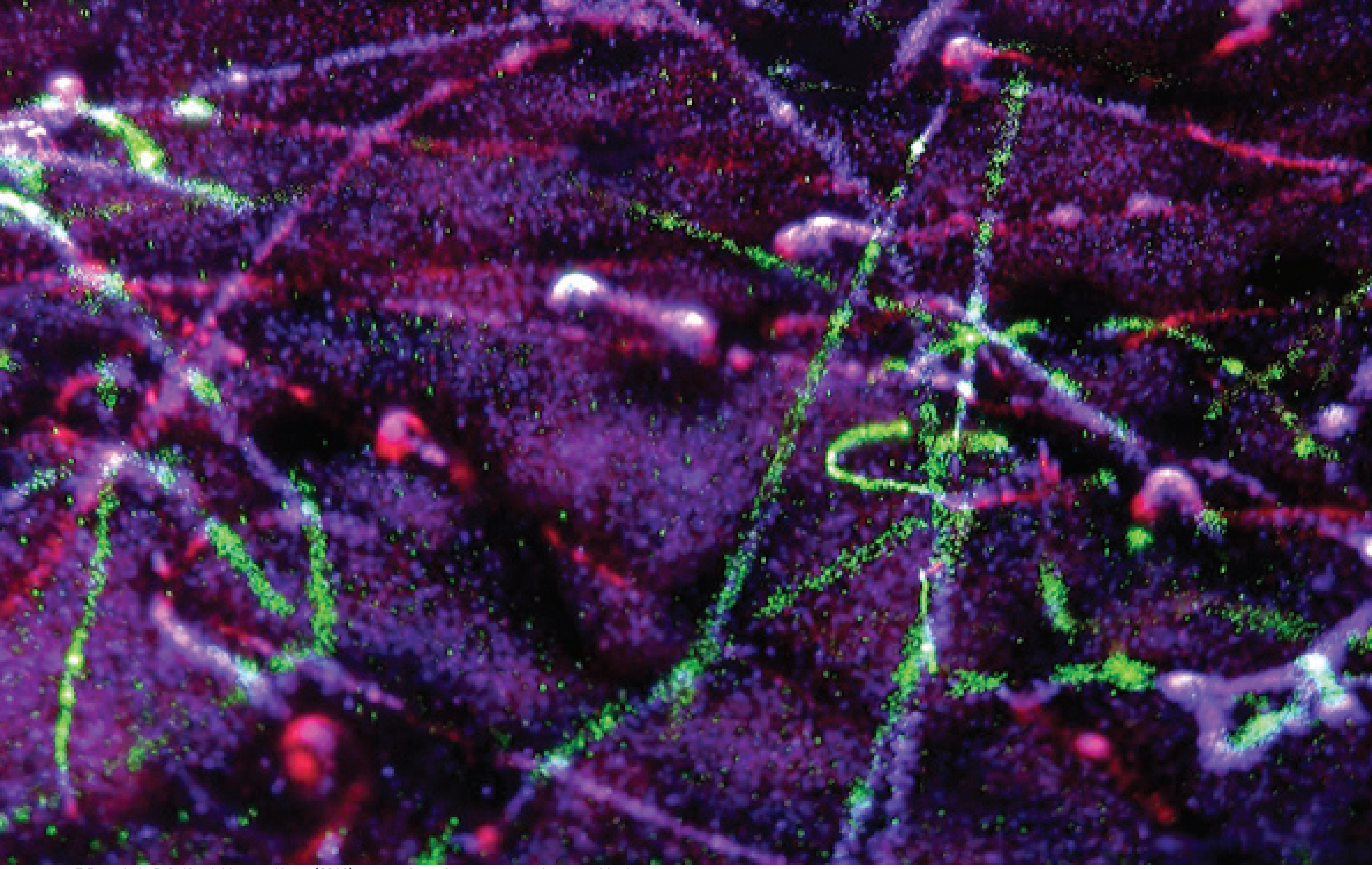
The creature known to have the most types of cones, counts as many as 16, and is called the mantis shrimp. Besides sensing polarized light, it has "hyperspectral color vision, spanning from ultraviolet to infrared" [14], trinocular depth perception. Considered to be the most complex eyes in the animal kingdom, these diversely faceted globules are mounted on mobile stems, constantly moving independently of each other and expanding the panorama. Along with pistol shrimp, these aquarians are the only known generators of sonoluminescence. The peacock mantis shrimp (*odontodactylus scyllarus*) uses bubble cavitation resulting in sonoluminescence to hit its prey twice with a single strike: "a powerful shock wave moving with an acceleration of a .22 caliber bullet follows a slam of a mighty claw" [15]. It is hypothesized that mantis shrimp cannot see the micro-temporal visual impression of their own single bubble sonoluminescence. However, with their immaculate eyes, they would certainly be able to perceive *Camera Lucida: Sonochemical Observatory.* How many colors would they see? What would they make of the recent discovery of two-colored sonochemiluminescence by quantum chemist, Shin-ichi Hatanaka?

Like insects, mantis shrimp are sensitive to polarization – to the orientation of light wave oscillations. Within their eyes are star-shaped alignments of photosensitive microvilli tubes. These cylindrical bundles form a wave-guide that behaves like a polarization compass, sensitive only to self-parallel wave fronts. Linearly polarized light travels along parallel synphase wavelengths of equal amplitude, whereas circular polarization refers to parallel, spiraling wavelengths that share the same amplitude but diverge in phase by 90 degrees. The unaided human eye is weakly sensitive to polarization, which creates a very faint pattern near the center of the visual field, called Haidinger's brush. Though the pattern is very difficult to see, with practice, the naked eye can learn to detect polarized light. In *Ten Thousand Peacock Feather in Foaming Acid*, one may closely observe such polarization phenomena as the Kerr effect – when a material's refractive (light-bending) index changes in response to an external electric field. Here, laser light is the source of the electric field, which spreads as a surface wave (soliton) across soap film. Proportional to the local irradiance of the laser, the variation of refractivity results in nonlinear optical effects such self-focusing, self-phase modulation and modulational instability. The Kerr effect only becomes observable with high amplitude light sources such as lasers.

The most powerful lasers are being used to scan the depths of subatomic noise. The deeper we go, the stronger and shorter the light pulses have to be, so as not to blur the fleeting details. The limits of high-speed stroboscopy are constantly being redefined, and the latest aspirant, the LHC (Large Hadron Collider) at CERN uses emissions that last less than a trillionth of a trillionth of a second (10-24). The photons are so ephemeral that they themselves cannot be observed, which is why they are called virtual photons. Though ideal for scanning catapulted particles, the naked eye prefers flashes that span at least a few millionths of a second. Such flashes (and far longer) can decelerate and even freeze the rapid micro-temporal interplay between acoustic vibrations and non-coalescing fluid droplets. Above the surface of upwardly sonicated silicone oil, a thin membrane of air, acoustically regenerated underneath each droplet, suspends falling droplets of the same liquid. Without coalescing for extended periods, these palpitating spheroids bounce on the air-oil interface. The repeated impact of a bouncing droplet incites a standing capillary wave that interlocks with the waves of neighboring droplets. This close-range attractive force can result in the orbital motion of droplet pairs and clusters. During more stable modes of excitation, self-organizing geometric rafts emerge in accordance with the closest packing of spheres: the distance between droplets decreases with increasing frequency, leading to dense lattice formation.

The sensorial demands of processing quantum behavior incite adaptive resonances, comprising a multidimensional perceptual navigator. Though brains have been compared to clocks, telegraphs, computers and holograms, they are "not like any artificial machine. If anything, they are like natural self-organizing processes such as stars and hurricanes" [16]. Occurring on many different scales of time and space, cascades of standing and traveling waves outline the adaptively resonating lattice of intercellular communication. These resonances can be finely tuned through a mesoscopic self-observation system, such as our work, *Mucilaginous Omniverse,* which translates quantum harmonic patterns across the cerebrospinal sea of neuromodulators. Ten million times larger than an atom, an acoustically bounced, non-coalescing oil droplet is the largest object to manifest the self-interferential signature of wave-particle duality. When the wave packet emitted by the droplet interferes with its own reflections, the droplet begins to drift or "walk" along the wave. "Such results are usually thought to be possible only in quantum physics" [17].

Ever since Newton and Huygen's discord about the nature of light at the end of the 17th century, wave-particle duality has remained a fertile domain in physics. For most of that time, Thomas Young's legendary double-slit experiment of 1801 was performed exclusively with light emissions. In 1961, however, the experiment was repeated with an electron beam. Then, in 1974 it was reproduced with a single electron and in 1999 with an entire fullerene - a massive 60-atom molecule. Whether or not one can visualize an object interfering with itself like a wave has been the subject of tempestuous controversy. As Richard Feynman, the architect of quantum electrodynamics, put it: "I can safely say that nobody understands quantum mechanics. Do not keep saying to yourself, if you can possibly avoid it, 'But how can it be like that?', because you'll go down the drain into a blind alley from which nobody has yet escaped" [18]. Just a few years ago, this blind alley was finally illuminated, enabling one to directly perceive quantum phenomena in real time with one's bare eyes and ears. Since its discovery, the wave-particle behavior of a walking droplet has raised numerous fundamental questions as to



E.Domnitch, D.Gelfand, Memory Vapor (2011), cryogenic environment, cosmic rays, white laser

the distinction between macroscopic and quantum reality. By virtue of its wave emissions, a droplet exhibits a non-locality dependent on its bouncing history, or path memory, as classified by the French physicist, Yves Couder. Perhaps, this non-locality gives rise to a macroscopic equivalent of entanglement, of tunneling, and of quantized orbits. When a droplet's path memory is sufficiently deep, its wave force is equivalent to that of its mirror image on the other side of the orbit. Likewise, it is a droplet's depth of memory that can awaken the quantum gaze of the observer.

References

1. J.S. Bell, *Speakable and Unspeakable in Quantum Mechanics* (Cambridge: Cambridge University Press, 1987), 171-172

2. Sonoluminescence: high frequency sound waves, propagating within a liquid, trigger the implosive collapse and subsequent light emission.

3. Psychomorphism: the attribution of human mental activity to inanimate objects

4. *Camera Lucida: Sonochemical Observatory* (2003 -2008), installation by E. Domnitch, D. Gelfand: within a transparent chamber filled with a gas-infused liquid, sound waves are directly transformed into light emissions by means of a phenomenon known as sonoluminescence. After adapting to the absolute darkness surrounding the installation, one gradually perceives the detailed configurations of glowing sound fields. Sonoluminescent emissions are mainly ultraviolet, with slight leakage into the visible spectrum.

5. I. Jerman, R. Leskovar and R. Krašovec, "Evidence of Biofield", in Philosophical Insights about Modern Science, eds. Eva Zerovnik et al. (Hauppauge, NY: Nova Science Publishers, 2009), 197 - 214

6. H. Azzouz, L. Alkhafadiji, S. Balslev, J. Johansson, N. A. Mortensen, S. Nilsson, and A. Kristensen, "Levitated droplet dye laser", Optics Express (2006), Vol. 14, Issue 10, 4374-4379

7. *Ten Thousand Peacock Feather in Foaming Acid* (2007); installation and performance by E. Domnitch and D. Gelfand

A white laser scans the surfaces of nucleating and dissipating soap bubble clusters. Unlike ordinary light, the laser's focused beam is capable of crawling through the microscopic structures within a bubble's skin. When aimed at specific angles, this penetrating light generates a large-scale hemispherical projection of molecular interactions as well as mind-boggling phenomena of nonlinear optics.

8. Y. Stoilov, "Laser beam in a soap film", UFN, 174:12 (2004), 1359–1369

9. According to the NASA Institute for Advanced Concepts, architectural assembly in microgravity is best accomplished by means of acoustic and electromagnetic force field tailoring.

10. J. Juknevich, "Pure-glue hidden valleys through the Higgs Portal", arXiv:0911.5616v1

11. N. Bohr, "The Quantum postulate and the recent development of atomic theory", Nature 121 (April 1928), 580-591

13. Homer, *Illiad*, XI, 29

14. S. Ings, *A Natural History of Seeing*, (New York: WW. Norton, 2008)

15. Scientists became interested in such versatile perceptual capacities and built sensors and processing systems for applications in space research, agriculture, minerology, optical physics, and surveillance. Hyperspectral sensors scan objects, using a vast portion of the electromagnetic spectrum. The resultant spectral signitures enable far more precise identification of an object's innards than the narrow band of humanly visible light. Fast computers, sensitive detectors, and large storage capacities are required for analysing hyperspectral data, since hyperspectral cubes are large multi-dimensional data sets. It is astonishing that a Crustacean brain can perform this colossal task so well! One of the other hurdles facing researchers is the quest to program hyperspectral satellites capable of sorting through data on their own and transmitting only the most important images -- both transmission and storage of so much data could prove difficult and costly.

16. W. Freeman, Neurodynamics: An Exploration in Mesoscopic Brain Dynamics. (New York: Springer, 2000), 4

17 . Y. Couder and E. Fort, "Single-Particle Diffraction and Interference at a Macroscopic Scale", Physical Review Letters 97 (2006), 154101

18. R. Feynman, The Character of Physical Law (Cambridge: MIT Press, 1965), 129

Evelina Domnitch & Dmitry Gelfand

Dmitry Gelfand (b.1974, St. Petersburg, Russia) and Evelina Domnitch (b. 1972, Minsk, Belarus) create sensory immersion environments that merge physics, chemistry and computer science with uncanny philosophical practices. Current findings, particularly regarding wave phenomena, are employed by the artists to investigate questions of perception and perpetuity. Such investigations are salient because the scientific picture of the world, which serves as the basis for contemporary thought, still cannot encompass the unrecordable workings of consciousness. Having dismissed the use of recording and fixative media, Domnitch and Gelfand's installations exist as ever-transforming phenomena offered for observation. Because these rarely seen phenomena take place directly in front of the observer without being intermediated, they often serve to vastly extend the observer's sensory envelope. The immediacy of this experience allows the observer to transcend the illusory distinction between scientific discovery and perceptual expansion. In order to engage such ephemeral processes, the artists have collaborated with numerous scientific research facilities, including the Drittes Physikalisches Institut (Goettingen University, Germany), the Institute of Advanced Sciences and Technologies (Japan), Ricso Lab (Russia) and the Meurice Institute (Belgium). They are the recipients of the Japan Media Arts Excellence Prize (2007), and three Ars Electronica Honorary Mentions (2007, 2009, 2011).