A (C)osmosis Art in-between Disciplines

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Edited by

Ioannis Michaloudis and Yuri Tanaka

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INTRODUCTION

FRANK WHITE

"Space" has many meanings.

To some, it refers to Earthly things, like the distance between people and places. During the recent coronavirus crisis, this definition became critical, as we were told to practice "social distancing." In more normal times, "space" can also refer to individuals singly, as in "personal space."

However, to a select group of artists, space refers to something else entirely, i.e., the cosmos, the universe, everything that is *not the Earth*. These artists focus their work on a field simply known as "space art."

As I wrote in a 2019 paper for the International Astronautical Congress (IAC), "space art" has been around for a very long time. If we include *writing* in our definition of the arts, we can find evidence of early "science fiction" dating back to Ancient Rome and the Renaissance:

> Some observers mark the beginning of science fiction with the ancient Sumerian epic, *Gilgamesh,* while others suggest this genre began with the scientific revolutions of the 16th and 17th centuries. Johannes Kepler himself, one of our greatest astronomers, wrote a fictional description of a trip to the moon called *Somnium*.
>
> Closer to our own time, Chesley Bonestell pioneered "space art" with his depictions of a potential human future in the solar

> system, complete with multi-stage rockets and space stations. In the mid-1950s, his illustrations of Wernher von Braun's space exploration vision gave a huge boost to the idea of an American space program[1].

When we look at both the past and the present, we can clearly see that artists are drawn to portraying space exploration and the human place in the universe. Perhaps this is because they are charged with the mission of all the humanities, which is to interpret what it means to be human. That meaning cannot possibly be described without dealing with the universe, cosmology, and in a word, "space." Being human means something specific if you believe the Earth is the center of the universe and that human beings were created by a divine force—the perspective of most people until the Renaissance dawned in Europe. It means something else altogether if you believe that the Earth is a small planet at the edge of the Milky Way galaxy and there are billions and billions of other planets in the universe, many of them capable of supporting intelligent life like us—which is today's perspective.

Science and technology are the driving forces in shifting our worldviews as they consistently transform our knowledge of the cosmos and our identity as a species. The Overview Effect, which I have spent more than three decades investigating, is an identity-shifting experience that many astronauts have shared with us surface dwellers. When in Earth orbit or on lunar missions, they see our home planet and the cosmos from a distance, an experience unique in human history. As my colleagues and I often say, they see the Earth "from space and in space."

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[1] Frank White, *The Overview Effect and the Arts*, Paper presented at the 70th International Astronautical Congress, 21-25 October 2019, Washington, D.C., United States. cf. www.iafastro.org

The view of the Earth "in space" has been somewhat neglected until recently. The astronauts not only see the Earth uniquely but they also view the universe in a special way, especially when they travel to the Moon.

A number of artists have found the Overview Effect to be a topic of great interest, and there are numerous paintings, videos, and even symphonies called "the Overview Effect" or some variation on that theme. However, the "Overview Effect genre" is really only a subset of this much larger category of space art.

This book highlights the efforts of several artists to make sense of the human place in the universe through art. In reading about their work, it is not difficult to conclude that "The cosmos is art."

The Artists

Ioannis Michalou(di)s (co-editor)

His artistic sensibilities have guided construction of the volume from the first day. Like the other practitioners featured here, his creations are powerfully connected to space exploration through "aerogel."

Developed by NASA to collect stardust, these substances are 99.9 percent air and .1 percent glass. Michaloudis states that the resulting "aer ( ) sculptures" transcend the limits of Euclidean geometry and open up the possibility to represent the space of Poincare and Picasso.

He says further that he was "looking for a cloud and found heaven."

Yuri Tanaka (co-editor)

Yuri Tanaka's work derives from her interest in a wide range of topics: the universe, mediation, "concealing beauty," and the "art of life."

She sees "the universe" as "everything," including all of nature and humans within the natural world. An interest in mediation for conflict resolution led her to mediation among diverse disciplines to create artistic installations evoking the experience that we are human beings in a universe that is alive and beautiful. She draws on a longstanding Japanese artistic tradition of "concealing beauty" to reveal this reality for all who are willing to see it.

Tanaka's work reflects her notion of "the art of life," which suggests that lived experience is itself art and that what we call "art" as something separate is a misnomer.

Her installations, almost all of which are located outside, reflect her transdisciplinary philosophy, involving engineers and collaborators with multiple skill sets. With Tanaka's encouragement, all of them become artists!

Arthur Woods

Arthur Woods offers the reader a comprehensive view of his own artistic journey, opening his essay with an analysis of humanity's efforts through the centuries to understand our place in the universe through cosmologies, at first supernatural, later scientific. He then describes how he grew up near Cape Canaveral and watched hundreds of rocket launches, including those of the Apollo program. Perhaps it was inevitable that his work would center on the cosmos.

Woods' artistic expressions emerge from his own cosmological musings, from his concept of "Greater Earth" (a grand extension of the physical Earth) to his idea of "The Space Option" (an evolutionary plan to meet the needs of humanity through space-based resources).

Among his more audacious projects was OURS (Orbital Unification Ring Satellite), a structure that would always be visible in the sky to symbolize unity and oneness.

While OURS never came to fruition, another project, Cosmic Dancer, made it to the Mir Space Station in 1993. Woods is clearly both a student of cosmology and an extremely talented space artist.

Dan Goods

While visiting NASA's Deep Space Network site at Goldstone, California, Goods experienced an epiphany. While staring at the large white antenna that sat there in the middle of the desert, he realized that it was sending and receiving signals that were far, far from the Earth. As just one example, the Voyager probe was, at the time, on the edge of the solar system, some 11 billion miles from where he was standing.

This moment propelled him as an artist on a quest to somehow visualize the two-way "conversation" that was going on between the antenna and the spacecraft. Would there be a way to represent that discussion visually or through sound, he asked. It took years, but ultimately resulted in three projects that use sight and sound to communicate something profound about our spacefaring machines, and their messages to Earthlings as they probe the depths of the universe.

Charles Ross

One word comes to mind in contemplating the work of Charles Ross: monumental. That is because the specific work featured in this book, "Star Axis," is indeed a *monument*. Rising out of the New Mexico landscape, it recalls the pyramids and ziggurats of the Aztecs, Mayans, and Babylonians. Like those earlier monuments, this one links the Earth to the heavens through its design and positioning on the Earth and in relation to the stars and planets above. The artist offers Earthbound humans a chance to uniquely experience the cosmos, with special reference to Polaris, the North Star.

The monument includes four chambers, "each with its own distinct energy." The Star Tunnel is at the heart of it, a stairway aligned precisely with the axis of the Earth. As you climb the stairs, you see an opening that frames increasingly larger circles in the sky, representing an orbit of Polaris in the 26,000 year cycle of Earth's alignment with the stars.

Ross says, "I realized I had to build Star Axis when I discovered that Polaris pulses in the human visual field." For Ross, the stars may be far away, but they are not inaccessible to us.

Richard Clar

The motivation driving Richard Clar's art is breaking through limitations and boundaries, and the limitation that all humans on Earth experience daily is gravity. The only people in the universe who, at this moment, are free from what we call "1-g" are those on the International Space Station! Thus, all Earthbound artists work within the constraints of gravitational forces. Clar says in his article:

For nearly four decades, my art has challenged the limitations of gravity...As artists, it is incumbent upon us to break free of

the boundaries that limit artistic expression.

Clar's work has taken many forms, but it always involved human exploration of the space environment, and often involved working with NASA to realize his vision.

From the "space dolphin" he hoped to launch as part of the Space Shuttle "Getaway Special" program to a visual representation of the space debris that is dancing around our planet to bouncing a recording of Neil Armstrong's heartbeat off the Moon, Clar sees boundaries as something to overcome in service to his art. And overcome them he has.

Sarah Jane Pell

It has often been said that all of us are the astronauts of Spaceship Earth. If this is so, how can we experience this reality when we exist within the gravity well of Earth, comfortably protected from the vacuum of space by our atmosphere?

Sarah Jane Pell has taken the challenge to heart, it seems, as she considers herself to be an "artist astronaut." Though she has (not yet) left planet Earth, she sees her terrestrial practice of art to be "performing astronautics." In pursuit of her quest, she has commanded and participated in analogue missions that reproduced, as nearly as possible, the conditions of outer space. She looks ahead to "Humanity 2.0," a new kind of human being adapted to the extreme environment that confronts us once we depart from the cocoon of our home planet. Pell never strays far from the physical, from the reality of being "embodied" and, in her words, "The artist astronaut asks new questions of the body in time/space," a body that may evolve in unexpected ways as it experiences the cosmos.

María Edwards

In a different format from the other sections in this book, María Edwards is interviewed by Alexia Talia to reveal her process of creating art and how it relates to the cosmos. For Edwards, "space" is that which lies between objects, and that which gives them relationship. She is fascinated with what she calls "the void," which she wishes to represent, without invading it.

For this artist, "time" also has a dimension of space, as the distance between what she calls "indivisible moments." As one experiment in time, she returned to New York City, where she had lived for four years. In forays throughout the city, she attempted to reproduce the earlier experience in one month and nineteen days.

Not to be limited to one place on the Earth, Edwards created a global work that involved "building an instrument that could connect distant times and places. It consisted of 11 swings installed in 8 European countries; 3 observatories in Northern Chile; and a piano in Austria as the sounding board of this fragmented instrument." For Edwards, the entire planet becomes her canvas.

Lumen Studios

Lumen Studios, a collective influenced in part by my work on the Overview Effect, (an honor, thank you) chose to curate an exhibition of "Cosmic Perspectives." While the Overview Effect is a concept that transports us out of our usual views of the universe, allowing us to see the Earth in space and from space, "Cosmic Perspectives" expand the discussion even further, allowing us to consider the universe itself, not only as a spatial construct but also in an "overview of time."

Lumen decided to make the title of their show plural to account for the many voices that would speak to this theme, in this case, 50 interdisciplinary artists. In other words, while one might expect that there is *a cosmic perspective*, the artists asserted that there are many perspectives, each depending on the perceiver, and that this openness to interpretation sends a message for our moment in time.

This volume considers the works of the artist/curators for the exhibition. They demonstrate deep concern with non-hierarchical structures and decolonization on the Earth as well as significant interest in the human relationship to the cosmos. As above, so below.

Summary

For many years, we have perhaps felt that describing outer space, the universe, the cosmos, is best left to scientists. We tend to think they understand the speed of light, black holes, and dark matter, after all (although they might admit that they don't!). However, the time has come, it seems, when artists are taking their rightful place as interpreters of the human experience of space with a capital "S." Is it possible that the structure of outer space is accurately reflected in the inner space of the artistic mind?

Read on!

I

(C)OSMOSIS ART

IOANNIS MICHALOU(DI)S
YURI TANAKA

The relationship of humankind to the cosmos has a very long history, and has raised many more questions than can be adequately answered. In the contemporary setting, some such questions can be cast as follows. Why has the cosmos been a source of awe and wonder for humankind since the beginning of human history? How are the arts of today related to our engagement with the cosmos? Who are the contemporary practitioners working in this field?

While this book represents a comprehensive attempt to respond to such questions, it also raises numerous others. Paradoxically, the more irrational such questions may seem, the greater the need for an idea such as *(C)osmosis Art*. This is because this anthology does not present a singular thesis on the topic of arts in the era of space science and exploration. Rather, through its parenthetical play on the terms 'cosmos' and 'osmosis', it proposes a radical opening up of new interpretive pathways between the multidisciplinary fields which constitute space science, and art which takes the cosmos as its broad theme.

The impetus for this anthology is to present both science and art as allegorical endeavors driven by experimentation, innovation and speculation. From the poetic mythology of Icarus, to the scientific rigors of rocket technology, the artworks and philosophies presented in this book clearly show the nexus between art, science and technology. Artists/researchers who have both been dedicated to the subject of cosmic art will edit this anthology, which will be the first publication on this particular theme for a general audience. Through the writings of the artists, we initiate a discourse on art inspired and driven by the fact that, from now on, we are enthusiastic observers of our Earth and the universe surrounding it.

Since the Earthrise photograph of our planet taken by the astronaut William Anders during the Apollo 8 mission in 1968, we have seen ourselves differently. We have been able to reduce enormous distances, expand our thinking and attempt to embrace the entire universe, open new cosmic vistas through the Hubble Space Telescope and create a plethora of new communications. These developments require a radically different artistic language able to identify and express new perspectives, concepts and opportunities. We expect this book to act as a point of departure, engendering the exploration of new artistic expressions.

Furthermore, by proposing the syncretic idea of *(C)osmosis Art*, we aim to introduce a new conceptual framework inspired by the interactions between art, science and technology. *(C)osmosis Art* is an invented word which combines the terms 'cosmos', 'osmosis' and 'art'. 'Cosmos' signifies the entire universe, both visible and invisible – as well as the ideas of causation, consequence and contingency. 'Osmosis' denotes the movement between semi-permeable boundaries

and the diffusion of elements in the search for equilibrium. We are convinced that art operates through the membrane of allegory to produce complex meanings subject to the constant play of disruption and equilibrium – across boundaries and between disciplines, and able to generate numerous interpretive possibilities.

II

(C)OSMOS IS ART:
THE OSMOSIS BETWEEN SCIENCE&ART AS A CREATIVE TOOL

IOANNIS MICHALOU(DI)S

Prologos

Pythagoras called the universe "cosmos" which means jewel in Greek. Cosmos encompasses paradox, so does art. Earth's atmosphere as the last layer of planet Earth could be considered like a diaphanous membrane protecting (but also connecting) our home planet to cosmos. For the author, imagination is a semi-permeable membrane uniting art and science through osmosis. As an artist, but also as a researcher and educator, I trust that the involvement of science and technology in art is not only beautiful but also defined to reshape the world in which we live in search of originality. Art should have innovation as science should have passion. Artists are the most influenced by the surroundings around them and thus, through their endeavors to express this, they use unexpected mediums and materials. With this perspective, I present here some of the practice of my work based on a technological medium used by NASA as a thermo monotonous nanomaterial to capture interstellar dust. To explore this nanomaterial named silica aerogel, I create sculpts from this, the lightest material in the world, thus enriching science's

messages from an artistic point of view. My objective is to explore the intangible and see it taking form in a substance that has no space. Nevertheless, you need more than all of your senses if you wish to "touch" it. This article explores, through various works made of silica aerogel, the osmosis between the cosmoses of art, science and technology as three inseparable domains.

Artistic Development and Realization

The author was invited in September 2001 by the artist Otto Piene, founder of "Sky Art," and Stephen A. Benton, physicist, inventor of the "rainbow hologram" [1] and ex-Director of the Massachusetts Institute of Technology's Center for Advanced Visual Studies, to conduct post doctoratal artistic research with the title *(Nephele)*^{3}: *Nephele to the third power*. In Greek *nephele* means "cloud," and the objective of this project was to realize what seems unrealistic and crazy: a cubic cloud, a cloud delimited in space by six invisible planes. For this research, the author had received a Fulbright Grant and a Research Scholarship from the Hellenic Government. During that collaboration with scientists and engineers at MIT, the author had the chance to see a small piece of silica aerogel. ". . . I was so surprised by the appearance of something that one is not quite sure is there! To believe your eyes, you need your hand, not only to touch, but also to handle, to move around, to press the material... thus you discover that this "frozen smoke" is so lightweight and delicate." Immediately, I thought of creating immaterial, ethereal sculptures with it. I knew nothing about aerogels, and the difficulties of its expensive fabrication, but I was certain that I had something important to do with it. I was looking for a cubic *Nephele* and I found the sky itself!..." [2].

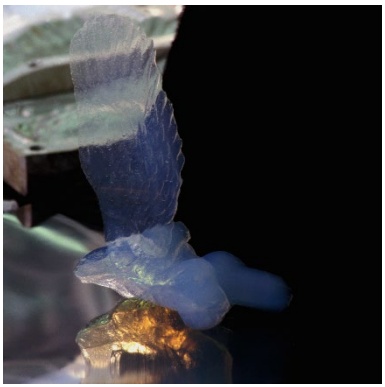
In September 2005, the double vessel of a 20 L high-temperature supercritical drying system (Fig. 2-1) was installed in a workshop in Greece under the author's responsibility. The setup was made by Dr. Michael Droege (Ocellus Technologies, CA, USA) who trained the author. Since then, all his *aer( )sculptures* have been created in the 20 litre vessel (diameter of 24 cm and height of 42 cm). The small vessel of one litre is for sampling, research and development. Using a new,

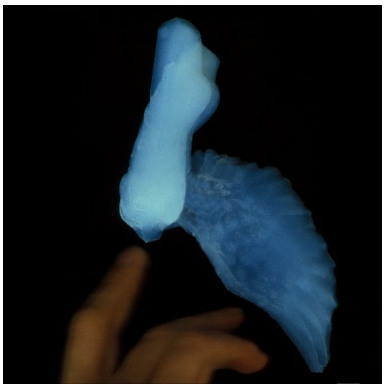
Fig. 2-1. The artist is opening the 20 litter high-temperature supercritical drying reactor after a continuous 48 hours run. The vessel was installed in Greece, September 2005, and all the *aer( )sculptures* have been created since then in it (photograph and copyright: Massimo Pizzocaro 2/2008).

two-step condensed silica process, Ocellus Technologies produces a light aerogel that contains 99.98% air. Ocellus make silica aerogels in a patented process that begins with a partially hydrolyzed silica solution to which they add water, a solvent, and a basic catalyst to form a gel. They then remove the solvent by supercritical conditions in an autoclave and replace it with air. This process takes a few hours; other methods can take days or weeks. Moreover, the process is flexible enough to let us produce aerogels with a wide range of densities from 0.7 to 0.001 g/cm^3. These data and the equipment we see in Fig. 2-1 indicate that even the 'production of ethereality' is dependent upon the heavy 'materiality' of an apparatus and process used for supercritical drying [3].

Functional materials usually find uses in technology. The author's writings are therefore, quite unusual for scientific and technological publications, as he presents a series of silica aerogel-based *aer( )sculptures* realized since 2002. No hypothesis is obvious in his papers… Instead, repeated concepts are resemblant of silica aerogel - a strange eerie substance, unfamiliar and alien. This material is the lightest solid on Earth and is used by NASA as a heat insulator for spacecraft and for the collection of stardust. Silica aerogel is indeed a remarkable substance: some 99% air and 1% glass. Silica aerogel is an amorphous form of common sand which is nonflammable, nontoxic and environmentally safe [2]. Also, it has an extraordinarily low density, averaging at 0.1 g/cm^3. Its lightness is ethereal, and is a property that provided to the author an advantage in his quest for omni-absence. When one encounters silica aerogel, particularly for the first time, one is compelled to touch it, to know it by extending her/his eyes to the fingertips. It is a substance that excites curiosity and projects mystery.

-Icare... I care | 2002





Figs. 2-2 and 2-3. Michalous, *-Icare… I care*, silica aerogel, 2002, CA, USA, © Michalous.

The first *aer( )sculpture*, made from this ethereal material was *'–Icare…I care'*, (Figs. 2-2 and 2-3) and was realized in collaboration with Dr. Michael Droege, at Ocellus Inc in California. The author took on the myth of Icarus as its subject matter; the famous story of the son of master craftsman Daedalus who constructed for his son a pair of wings from feathers and wax in order to escape Crete and the oppression of king Minos. Daedalus also made himself a pair of wings and tested them before his son took flight. When fleeing the island, he warned the young Icarus not to fly too close the ocean nor the sun, but to follow only in his trail of light. However, the foolhardy boy drunk on the feeling of both liberation and flight soared in the heavens, too close to the sun and melted the wax bonding the feathers to his body; plunging eventually to both the sea and to his death.

Every aer( )sculpture appears blue only when its background is black. The same optic phenomenon – raylight scattering – explains why our sky is blue, as behind it lays the darkness of

chaos. *-Icare…, I care*, is made out of two pieces, the torso and the left wing to represent the first mythological pilot Icarus on his fall from the sky. In this sculpture, the torso is thicker than the wing, and for this reason, when white light scatters at its silica and air components, the torso of Icarus appears more blue/white than the blue/transparent wing. But this natural blue color is present not only of Raylight scattering, but also for a second reason. Behind the wing is a clear background, but behind the torso there is a black background. The *aer( )sculpture* appears blue only when its background is black. In other words, the sky is blue because behind it there is the darkness of chaos.

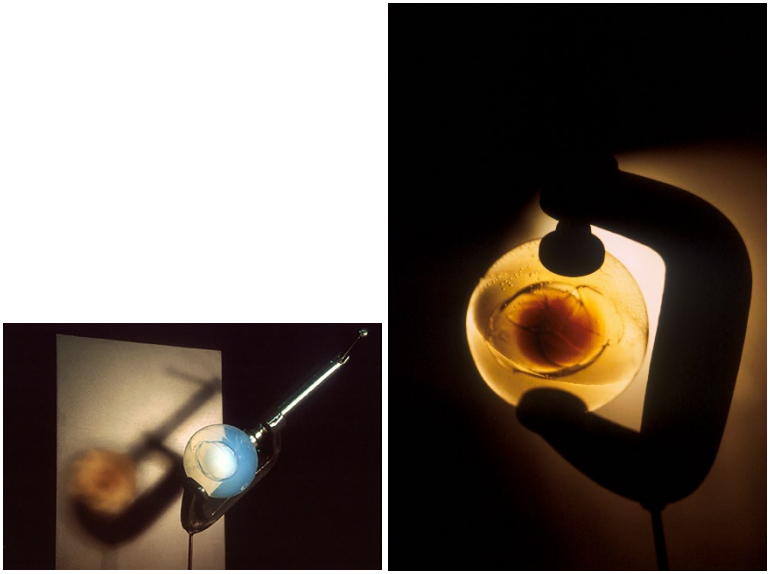
For its creation, the author twice visited Ocellus Technologies in California, in May and October 2002, when these pictures were captured. Using a new, two-step condensed silica process, Ocellus Technologies produces a light aerogel that contains 99.98% air. "We make silica aerogels in a patented process that begins with a partially hydrolyzed silica solution to which we add water, a solvent, and a basic catalyst to form a gel. We then remove the solvent by supercritical conditions in an autoclave and replace it with air. This process takes a few hours; other methods can take days or weeks. Moreover, the process is flexible enough to let us produce aerogels with a wide range of densities from 0.7 to 0.001 g/cm^3" [4]. In his first encounters with aerogel, the author found the ecstasy of Icarus. Through this material, he soars into the heavens and touches the sky.

A Portable Sunset |2002

Figs. 2-4, 2-5, and 2-6. *A Portable Sunset*, water vapors, hydrophobic silica aerogel, ©Michalous, 2002, MIT, MA, USA.

The work *A Portable Sunset* (Figs. 2-4, 2-5, and 2-6) shows another successful experiment at MIT. There are two reasons for the title of this work. The first, obviously, is the Mie scattered sunset color of all three images (which is obtained by keeping a piece of hydrophobic silica aerogel between a white light and the camera). The second reason for the title is that hot water vapors were imprisoned within the mesoporous structure of this sample. These vapors had created a lenticular cloud that completely disappeared after 9 min (the series of three photographs were taken 3 min apart). In every *aer( )sculpture*, the orange–gold hue can appear if we keep the sculpture between our eyes and light; then the sculpture has an orange and not a blue hue [3].

E(r)gonomic | 2003



Figs. 2-7 and 2-8. *E(r)gonomic*, silica aerogel & C-clamp, Alexandria, VA, USA, © MICHALOUS, 11/2003.

For the work *E(r)gonomic* (Fig. 2-7) we had used a C-clamp to hold a sphere of silica aerogel of a diameter of 50mm. The center of this sphere was intentionally not supercritically dried well. As a result, the center of the sphere remains white, a transparent white. Thus, the white center becomes a gold-orange one, once the light transpierces it (Fig. 2-8). The above inspection of our aerogel sculptures and their exotic beauty - deriving from the same natural phenomena that create the colors of the sky - drives us to our first conclusion that every *aer( )sculpture* is made out of light! And that is because the 99.98% of air that every sculpture contains is not free, but captured forever in all these open nano-pockets of silica, into all these billions of transparent "silica parentheses". Therefore, thanks to the supercritical drying, the glass foam forming our sculptures

will not be ephemeral [2]. After the formation of the gel, supercritical drying will alchemize the evanescent beauty of silica bubbles into a frozen-forever magnificence. Only this process - and the photography - can capture and keep for evermore the short-lived foam beauty. The 0.02% of silica and the supercritical drying can metamorphose the silica's nothingness into ethereality.

MneC_2H_5OH (Mnemonic Ethanol) | 2003

Figs. 2-9 and 2-10. *MneC_2H_5OH (Mnemonic Ethanol)* Cambridge, MA, USA, © MICHALOUS, 2/2003).

The work *MneC_2H_5OH (Mnemonic Ethanol)* (Figs. 2-9 and 2-10) shows how peripheral light transpierces and embraces the silica aerogel sculpture. This sculptures form is derived from the head of a Protocycladic small idol made around 3000 BCE. We kept the same form, but changed the material from marble to

silica aerogel. By exchanging the heavy white marble with the ethereal blue silica aerogel, we give this almost archetypal form the impression of a cloudy cultural memory. In Fig. 2-9 we can perceive three colors and three shapes. The silica aerogel sculpture is on the left side of the picture, positioned on a black aluminum rod to help the display the sculpture. The attendees of the 7th International Symposium on Aerogels may remember that *MneC_2H_5OH* was on display in the main lobby of the hotel and a red laser line scanned the *aer( )sculpture*. The result of this red laser scanning is the reddish profile we see in the middle of Fig. 2-9. As far as the well-detailed orange head seen on the right of the photograph in Fig. 2-9, this is the Mie-scattered paradoxical shadow-projection. Thus, by using a white light and a laser beam we can have three different images and colors from the same *aer( )sculpture*. Our sculpture has more than one image and it is hard to understand which of these images is the real one (if reality means materiality). And each of these images refutes oneself: as silica aerogel is doing the same [2].