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LASERIUM: NEW LIGHT ON AN ANCIENT VISION

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Although it may be a long time before projected light is widely accepted as high art in our society, there can be no doubt that within Laserium and the experimentation with laser projection lie seeds of what will become the high, universally acclaimed visual art of the future.

A dynamic art of pure projected light and color is one of mankind's ancient dreams. It was probably born before history, in the flickering campfire glows which played across the rock walls of our cave-dwelling ancestors. The constant motion and change of the forms of projected light must have been a powerful stimulus to the imagination and emotions of primitive man. More than two thousand years ago, this dream gave rise to the first recorded systematic presentation of projected light, in the shadow theaters of China and Java. Aerial fireworks, another form of projected light, were born at roughly the same time and place. In Western culture, the desire for visual spectacle and stimulation led to the development of candlelight displays and theatrical lighting effects from the Middle Ages on. In the seventeenth, eighteenth, and nineteenth centuries the optical theories and experiments of Newton, Goethe, Chevreul, and others slowly layed philosophical foundations for the concept of a *fine* art of projected light. In the later nineteenth century, Impressionism added to those foundations with a revolution that marked "the birth of light in painting." The Impressionists' new way of thinking about light and color as autonomous entities, independent of objects and narration, helped to extend the domain of high art to include dynamic light forms as well as static object forms. The Impressionists concerned themselves, at least superficially, with the technology of vision. Their art reflects their interest in light and motion and the sciences which sought to explain them. And their philosophies gave rise to the notion that high art might someday have as much to do with the traditions of science as with the traditions of art. The dramatically accelerating technologies of our century have rendered that notion all the more attractive and intriguing, and they have helped to propel that ancient vision of a high, projected light art far along toward an ultimate realization, a realization which must someday profoundly color the culture of the entire world.

In 1905, Thomas Wilfred, then a sixteen-year-old student of music and art, began in his native Denmark to study the color theories of Newton, Huygens, Rimington and others, and to experiment with projected light.[1] Fourteen years later, in 1919, Wilfred's dedicated explorations, by then transplanted to America, yielded the first truly effective electro-mechanical, incandescent-light color projection instrument, which he called the "Clavilux." In the course of half a century, up to his death in 1968, Wilfred continually expanded, varied, and improved his "oeuvre" of Clavilux machines. With these machines he developed a highly original and sophisticated system of projected light composition, to which he gave the name "Lumia." In the 1920s and '30s Wilfred enjoyed a substantial commercial success with his Clavilux concert tours. The success of Lumia as an entertainment novelty provided Wilfred with financial resources to explore its larger possibilities. Toward the end of his life, his creations began to receive recognition as an important contribution to modern visual art. During his final decade, he was awarded a number of major commissions, the most notable being a permanent, automatic, continuous play Clavilux installation (*Lumia Suite,* op. 158), housed in a special theater at the Museum of Modern Art in New York. In the days of Wilfred's youth, the color organ was little more than an exalted vision in the minds of Rimington, Alexander Scriabin, and countless other inventors, artists, and dreamers.[2] Wilfred took the dream and with persistence and genius forged it into the effective reality of an absolute, dynamic art of projected light.

Up to this time Wilfred has been the most dedicated, prolific, and significant figure in the history of light art. However, the same dreams and theories which blossomed in his work took root also in the minds of many of his contemporaries. Throughout this century there has been a steady, if not always spectacular, interest in the development of absolute and abstract light composition. This interest has constantly been stimulated by the restless advances of our scientific and industrial technology, with its offerings of new and better means to generate and manipulate light. The development of cinema at the beginning of this century was of course a momentous technological breakthrough. In 1917 the Swedish painter-filmmaker Viking Eggeling began to use film for his experiments in composing absolute, non-narrative visual forms. Other artists, such as Hans Richter, soon followed in his footsteps. But since true color was not yet available in cinema, the visionaries of projected *color* art had still, like Wilfred, to develop technological avenues other than film. In 1922-23, Ludwig Hirschfeld-Mack, a young artist associated with the Bauhaus circle, assembled an ingenious apparatus of colored lights and projection boxes with which he transformed Paul Klee's colorful "fugal" paintings of 1921-22 into a dynamic, measured, temporally unfolding form of absolute projected light art, set to a score. Between 1921 and 1930, Laszlo Moholy-Nagy built his *Light-Space Modulator,* a motor-driven kinetic sculpture which reflects and deflects beams of light into ever-shifting patterns, played around a 360-degree environment. Such experiments are of great interest historically, but they never got beyond gross mechanical problems to the stage of fine-tuning the visual experience.

In the late 1930s, perfection of the Technicolor film process opened a new world of visual possibilities. The filmmaker-impresario Walt Disney, with a huge studio and Pharaonic legions of animators at his disposal, was able to exploit these possibilities to the full in his magnum opus *Fantasia,* released in 1940. *Fantasia* is a milestone of cinematic and artistic history, and to this day its best segments remain a supreme statement of the riches attainable in abstract and absolute projected color. Yet immediately after the great success of this classic film, the exploration of projected color fell into a sharp decline. Historical and economic factors combined to submerge it again, for over two decades, into the quiet province of a few dedicated explorers and technicians. A devastating war diverted the attention of the Western world away from advanced art. Then too, Disney's labor-intensive animation techniques, possible in the Depression economy, were no longer financially viable when animators had to be paid. Further advances in light art demanded newer, less labor-intensive technologies. But American technology, which more than anything else had made possible and spurred on modern developments in light art, became

engrossed in the war, then in rebuilding the world, and then, in the 1950s, in consolidating the American mercantile empire. It was not until the 1960s that the technological sector of our society could relax enough to redirect its attention. By that time, America, capital of commerce, industry and science, had come to a new consciousness of itself as a center also of world art—a true imperial capital. This new spirit generated a new fervor to wed our technology with our art, and so to celebrate both. One result was a revival of interest in absolute projected color composition. The reputation of Thomas Wilfred was resurrected. Special, absolute color effects assumed a prominent place in some major cinematic works, such as Stanley Kubrick's *2001*. In the later 1960s, a novel form of light display, the "light show," combined a variety of projection media—film, slides and overhead projectors, and briefly flourished as visual accompaniment to the emergent, serious rock music of that era. And in those same few years, '68, '69, '70, a number of scientists and artists began to speculate that dramatic new hopes for the ancient vision might lie in one of the greatest technological innovations of the age—the laser.[3]

The laser (acronym for light amplification by stimulated emission of radiation) was developed in the late 1950s, based upon research done at M.I.T. by Charles Townes and Arthur Schawlow. A decade of additional research produced hundreds of critical applications for this tool in communications, heavy industry, and medicine. Then its potential for art was recognized. The extraordinary coherence of laser light, i.e., its "straight-line" character, prevents its forms from diffusing when projected across great distances. This unique projection property, which yields unprecedented resolution, intensity, and saturation of color, seemed to hold exceptional promise for projected light art. Many physicists and engineers around the country began playing with aesthetic as well as scientific experiments in their laser laboratories. It was one such researcher, Elsa Garmire of Caltech, who in 1970 introduced the state of laser art to a young Californian named Ivan Dryer. Taken by the great beauty and intensity of this new kind of light, Dryer tried to make a film using laser-generated images, but he found that celluloid could not begin to capture the power and immediacy of the live laser. As is so often the case, a great idea was born out of frustration. Seeking another route by which to transmit laser art beyond the laboratory walls, Dryer conceived the idea of *Laserium,* a remarkable entertainment medium which has emerged as the most recent stage in the long progress of projected light art.

In 1971 Dryer founded a company called Laser Images, Inc., to propagate and promote laser art, and to develop avenues to a mass audience. He hit upon the idea of presenting laser shows in planetariums, ready-made venues with a clientele already prepared for a different kind of visual experience. The planetarium proved to be a uniquely effective setting for a drama of projected absolute light and color. The first regular schedule of Laserium concerts was instituted at the Griffith Observatory in Los Angeles in November of 1973. In the four years since that beginning, ongoing Laserium performances have been established in about a dozen North American cities and in Kyoto, Japan. Roughly four million paying customers have been drawn to these concerts—a truly impressive statistic for a fledgling art form.

Dryer's role in the development of light art is that of entrepreneur, developer and promoter, as much or more so than that of artistic creator. He has orchestrated and elaborated upon the techniques of other laser researchers as much as he has invented his own. His relationship to laser art is something like the relationship between Thomas Edison and the incandescent light bulb, or that between Henry Ford and the automobile. Each of these men was heir to a long history of theory, experimentation, and partial success in their fields. None was wholly an originator. But all of them were able to extract the essentials, to forge the work of their pioneering predecessors into an effective product, and then to maintain the conviction, enthusiasm, energy, and ingenuity to prove to a skeptical world that said product was exactly what it needed. The role of such persons has been crucial: Without them the great things of our age might not be available to us.

The heart of *Laserium* is an elaborate but compact projection system developed by Dryer and his company in collaboration with its manufacturer, Spectra Physics. The projection unit is a rectangular solid in shape, roughly six feet high by three feet square. It is operated from a console set alongside, which is covered with switches, potentiometer dials, and "joy-sticks." A laser performer, or "laserist," plays this instrument. The *Laserium* format is encoded on a four-channel tape, which is run on a TEAC 334OS deck enclosed in the projector. Two of the channels contain stereo music, one channel contains introductory and voice-over narration, and the fourth channel carries the data which sets up the projector for each particular piece. Although the format is pre-programmed and defined within limits, the laserist has broad latitude in selecting tempos and altering or interpreting the basic image sequence set forth on the tape. There is even the option to override the programmed piece entirely in favor of some original composition by the laserist, although management discourages this practice. Most of the laserists hired and trained by Laser Images are musicians, and the principal requirement for candidates, besides visual sensitivity, is a gift for improvisation within a defined rhythmic structure. A *Laserium* show could be wholly automated, but the element of live performance adds critical dimensions of personality, vitality, and variety. Indeed, each performance, like the performance of given works of music, can be an experience at once familiar and unique. I myself saw two *Laserium* shows (*I* and *II*) a total of twenty-seven times. Never did I feel that I had completely exhausted their potential for new experiences and sensations.

Each *Laserium* show lasts about an hour and consists of a number of visual pieces set to various works of music. In *Laserium I* there are a dozen pieces, in *Laserium II* there are fifteen. The longest of these, entitled "Light Year," is set to "Abaddon's Bolero" by Emerson, Lake, and Palmer and lasts seven minutes and fifty seconds; the shortest, "Solar Wind," is set to the adagio from Corelli's Concerto Grosso op. 6, no. 9, which lasts one minute and forty seconds. Each show runs through a broad gamut of moods and tempos, embracing old master classics, light classics, progressive rock, pop, ragtime, bluegrass, and synthesizer interpretations. The composers represented include Copland, Respighi, Boston, Johann Strauss, Sousa and Joplin, to mention but a few. Both shows begin at a stately andante and build in speed and intensity. In *Laserium I* there is more of a sense of continuity, unified conception, and building toward a climax than in *Laserium II,* which seems more like an anthology of individual selections.

Dryer's projection system is a complex affair, protected by patent applications and proprietary secrets, so its inner functions cannot be laid bare in detail here. To describe it broadly, *Laserium* is created with a one-watt, krypton gas laser beam, one-eighth of an inch in diameter, greenish in appearance but white-like in its wavelength composition. In the primary image-making process, this beam is split by prisms into four beams of its component colors—red, yellow, blue, and green. These secondary beams are then manipulated by other prisms, and by motor-driven mirror "scanners" and oscillators, and they are used as instruments for drawing upon the planetarium dome. Extremely rapid motions repeated at hundreds of cycles per second create pattern lissagues—i.e., the effect of closed linear forms (Figs. 1, 2, and 3).[4] In the second major image process, the beams are spread into gauzy, weblike, moiré patterns and gaseous-cloud formations (Figs 4 and 5). Other processes produce kaleidoscopic, mirror-multiplication patterns (Fig. 6), and static, diffraction-grating patterns.

This laser-generated imagery is used both absolutely, for its

intrinsic visual richness, and abstractly, to mimic, pun, or suggest certain kinds of experiences which we ordinarily associate with certain types of music. In *Laserium II* there is a piece set to Sousa's "Washington Post March." The visuals open as four bars, each a different color, and appear one at a time in the rests of the four-bar introduction. As the march theme swings in, the bars begin to twirl and leap around each other, assuming the character of a majorette's batons. The broad, surprising humor of this effect is never lost upon *Laserium* audiences. A similar kind of burlesque amusement is provided by colored squares which literally "square dance" in a piece of the same name, set to an Emerson, Lake, and Palmer version of Aaron Copland's "Hoedown." A somewhat more subtle and original effect of humor is created in a piece set to Scott Joplin's "Elite Syncopations." A spread of little circles of various hues covers the planetarium dome. There is an intriguing effect of depth, because differences in light intensity and size produce the illusion of circles situated at varying distances from the viewer. The circles pulsate and twitch, as if tickled by the syncopated rhythms of the rag. At the halting point of the first internal cadence-resolution (typical of classical ragtime), alternate circles collapse into horizontal straight lines, giving us the impression that they have fallen over backwards. In context this is very amusing. Such effects are not especially profound, and are perhaps even silly, but in their simple way they show us clearly how absolute visual imagery can directly touch our emotions.

Of course, the best, most significant effects of *Laserium* lie in a plane of seriousness and dignity higher than that of slapstick comedy. In one piece, concentric circles appear to rotate gracefully in opposing directions upon horizontal, vertical, and oblique axes (Fig. 3). Geometric ballets of this sort generate startling and evocative illusions of fluid space and plasticity. Against a background of slowly shifting stars projected by the planetarium star machine, a color-saturated gaseous-cloud or moiré formation moves and swirls at a tempo contrasted to the star motion (Fig. 1). Superimposed upon this cloud, a group of linear figures swarms and dances about—closer to us, farther away, in every direction—at yet a third tempo. All of this complex rhythmic interaction creates the most delicious, lyrical, visual polyphonies and exquisite spatial play. To a synthesizer composition called "Sequence: 14," a monolithic green bar opens up and spreads into filmy, gossamer sheets, all in constant motion. It is like a literal illustration of Kandinsky's *Point and Line to Plane* theory in a visually arresting form.

One particularly powerful effect results when figures are formed from very dense networks of lines (Figs. 2 and 7). This produces a shimmering and rippling of the colors, like interferometry patterns. One version of this effect takes the form of concentric rings of color, something like a huge phase pattern or dynamic diffraction grating, expanding and contracting above the audience. The burning visual vibrato which results is overwhelming in its intensity. It is almost unbearable to train the eye on it continually, and yet the effect is so hypnotic that it is hard to look away. Another form of this effect appears in that longest and most ambitious of the pieces, "Light Year," set to "Abaddon's Bolero." Here lines of color twirl like lariats, becoming spirals and then dense cones of gleaming, nearly blinding light. Like all traditional bolero dances, this one builds up in almost excruciatingly slow measure. The visuals build right along with the music, in equally deliberate and concentrated gradation, driving toward an explosive, furious climax.

Two of the laser selections struck me as consistently above the others in quality. Both are in *Laserium II*. One is done to a haunting piece of music called "Upon Enchanted Ground," a delicate, space-age-baroque chamber composition by Alan Hovhaness for flute, keyboard, cello, and occasional drum. The visual work opens upon a dot of blue which proceeds to twist itself into a fragile gyre or horn-like form, which circles and pulses in dark space (Fig. 8). This sight strongly suggests some mysterious, wondrous struggle of birth and growth in nature, as the figure takes on distinctly animated properties. This is the most refined, subtle, and restrained idea in *Laserium*, and yet it is also the most moving and profound. The other work to which I would call special attention is more characteristic of the overall *Laserium* experience. It is the resounding finale to *Laserium II*, set to a rock composition entitled "Foreplay" by the group *Boston*. This musical work features rolling, swelling, Bach-like keyboard arpeggios, riding upon a roller coaster of harmonic modulations, punctuated by crashing, staccato ensemble chords of the guitars, keyboards, drums, and bass. To this accompaniment the skydome becomes covered with frenetic scribblings of colored lines—sometimes continuous like bales of visible electricity (Fig. 9), and sometimes broken up by strobing into swarming, swirling fragments. This experience might best be compared to the drip paintings of Jackson Pollock, upon which the concept of artistic scribbling so largely depends. The furious psychological and physical energy of it is surely something like what Pollock hoped to pour into his canvases. It is in any case certain that *Laserium* has made many people understand the force of such lines in a way that Abstract-Expressionist and Absolute-Expressionist painting never has.

So many different things are happening simultaneously in most of the *Laserium* pieces that it is virtually impossible to see and apprehend them all, much less to describe them adequately. Attempts to illustrate *Laserium* with still photos are even more misleading, because it has no static imagery: Everything

is constant motion and metamorphosis. This inexhaustible richness and unending variety represent one of the many advances marked by Dryer's productions over their predecessors in the field of projected light. Other *Laserium* advances can be attributed to the unparalleled color saturation and unprecedented image resolution of the laser beam itself, to Dryer's inspired choice of the big planetarium dome as his projection vehicle, and to the extraordinary agility of the Spectra Physics projection machine. These technical achievements make possible an immense range of contrasts—between the big and small, the fast and slow, the intimate and overwhelming, the hazy and resolved, the strident and muted, form and chaos, coarseness and refinement, violence and genteel elegance, the near and far, the earthly and cosmic, the infinite and the infinitesimal—a range of contrasts never before attainable in a single work of visual art. Moreover, the great range of color intensity makes possible exceptional effects of overlapping and recession into depth, spatial effects which are aided immeasurably by the concave shape of the planetarium dome.

Early in our century the painter Robert Delaunay declared in his essay "On Light" that the relationships of color contrasts in depth constitute the essence of vision, and that "the synchromatic movement of light . . . is *the only reality.*" From this he concluded that the movement of the light and color should be the only true concern of the visual artist. Ivan Dryer seems to be one of those who has heeded this injunction, whether consciously or unconsciously. Indeed, the technical advances of *Laserium* have made possible a living world of growth, change, and development—a unique reality of light in motion—within an abstract-absolute format. Furthermore, Dryer has shown that all of this can be done with only *four colors.*[5] Finally, it is not the least amazing aspect of Dryer's achievement that he has found a way to make abstract-absolute art a big seller, palatable to multitudes.

It is true that *Laserium* might at present be criticized, by the standards of high art, for a certain immaturity. It sometimes seems more like a catalogue of effects (like those early stereo effects records) than a coherent, self-contained, integral artistic statement. It sometimes seems to bludgeon us with devastating optical explosions, like fireworks, instead of developing consistent ideas. Sometimes, too, the visuals lack a sufficient identity of their own and depend too much upon the musical selections for their identity and continuity. And in this current period of anarchy in visual art, where no structural idea seems to reign supreme, *Laserium* offers nothing in the way of a strong, clearly defined structural concept to fill the vacuum.

Nonetheless, Ivan Dryer must be commended for orchestrating a visual experience which speaks so directly, diversely, and powerfully to our emotions. I fear that the experience of static visual arts has grown somewhat too esoteric and overrefined in our time. In the eighteenth century, Diderot spoke of the power of painting to awe him, to instruct him, to "regale his eyes" and move him to deep emotions. Before the advent of cinema and television, static visual art provided entertainment, instruction, drama, and inspiration. Truly, how much of these things do we derive from the object visual arts today? Dryer has sought to give us a fresh, unexhausted vision. He has put real drama and entertainment into a truly modern, nonnarrative visual art form, and he has found, in his own words, "ways to use art to rekindle wonder and delight in the midst of our darkest anxieties." No artistic purposes could be higher than those.

Although it may be a long time before projected light is widely accepted as high art in our society, there can be no doubt whatever that within *Laserium* lie seeds of what will become *the* great, high, universally acclaimed visual art of the future. Ivan Dryer's goal is an ultimate art, and nothing less. He speaks of his creations in terms both serious and apocalyptic. Although short-run economic viability and mass appreciation are important considerations for him, he is extremely sensitive to timeless aesthetic issues as well. Like many others, myself included, he foresees a day when video projectors and video cassette equipment will largely supplant static, wall-hanging art with a dynamic art of light in constant change. Dryer is a man who has dreamt an ancient dream and means to make it reality within his lifetime. Who is to say, in this age of technological miracles and realization of ancient dreams, that it will not be so?

1. On Wilfred, see Donna M. Stein, *Thomas Wilfred: Lumia. A Retrospective Exhibition* (Corcoran Gallery of Art, Washington, D.C., 1971).
2. Scriabin's 1910-11 symphony *Prometheus: The Poem of Fire* was scored to include a color organ, which did not yet exist.
3. Some early efforts at laser art were exhibited in the show *Laser Light: A New Visual Art* (Cincinnati Art Museum, 1969).
4. This process is in some respects analogous to the way in which a cathode-ray tube draws upon an oscilloscope screen, except that in the cathode-ray tube, persistence of fluorescence in the screen coating serves the function of persistence of human vision in response to the reflected laser light. Many of the linear forms seen in *Laserium* will be familiar to those acquainted with computer-graphic art displays.
5. This represents an inestimable contribution to the rationalization of the art of color composition, so long plagued by an infinitude of color choices which has made each would-be color composer an eccentric, locked within his own personal game. The art of musical composition would never have attained its heights of the eighteenth and nineteenth centuries had it not been for the division of the continuous sound spectrum into eight (or twelve) standardized tones. This permitted one composer to build upon another's achievements, because all could speak more or less the same language. A similar division, standardization, and restriction might have a similar effect in dynamic color composition, where motion, change, and development can take the place of color variety in creating rich and subtle expressions. If we allow for 15,000 or even 1500 different colors, as in traditional painting, there is no hope for mutual understanding. That is why color has traditionally been regarded as an irrational, unteachable element in painting. But in a dynamic form of color art, a real language becomes an authentic possibility.