LASER LIGHTSHOWS

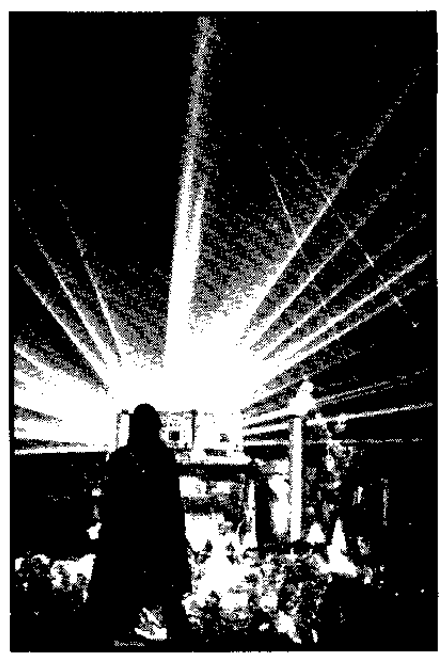
Lasers for entertainment looked at by starry-eyed Jim Perry

"AND ON THE FIRST DAY there was light, but it was incoherent . . . . it was a long time before coherent light was produced, July 1960, the birth of the Laser. The first laser was produced by Theodore H. Maiman, while working at the Hughes Aircraft Research Laboratories in Malibu, California. This first laser was a Pulsed Ruby type.

Lasing mediums currently in use include Chromium (Ruby lasers); Neon, Argon, Krypton and CO_2 (gas lasers), organic dyes (liquid lasers), and recently, certain semiconductors. The method of pumping energy into the medium determines whether it will be a pulsed or continuous laser. Optical pumping, focussing a bright light source such as Xenon flashtube on the lasing medium, is used with Ruby and liquid lasers providing a pulsed laser output. Continuous lasing is possible with gas lasers, where electron collision pumping, sending an electrical discharge through the gas filled tube, is used.

Early Experiments

Even though lasers have now been around for 17 years, very few people have actually seen one! Apart from the scientific and industrial uses, lasers also are amazing just to look at (not directly into the beam though!). This was realised as early as 1967, when people started artistic experimentation with lasers, projecting the beam through various transparent materials (such as crystal cut glass) to produce abstract patterns, and moving effects.



Laser light is an impressive sight because of the dynamic-almost tactile-purity of it. The air in fact can appear to be solid, if dust is present in the path of the beam. The early experimental laser lightshows used this property, in conjunction with smoke machines, to produce numerous shafts of red 'solid air' moving over peoples heads.

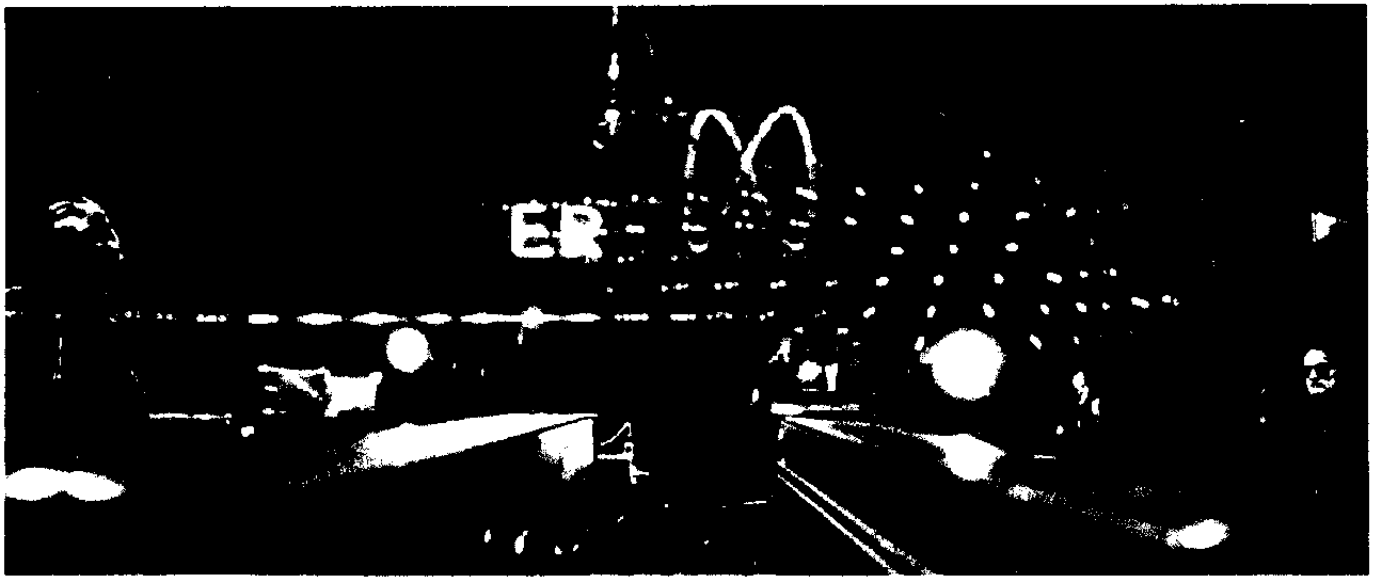
It was soon realised that vibrating mirrors could be used for more complex images. One of the earliest uses was at the 1970 World Exhibition in Osaka. Pepsi-Cola commissioned Lavell Cross, Carson Jeffries and David Tutor (from Mills College, U.S.A.), to build Video / Laser II for use in the Pepsi-Cola Art and Technology Pavilion. This system produced complex Lissajous type patterns within the confines of the Pavilion, and was more sophisticated than the simple "mirrors stuck on a loudspeaker" approach used previously, but still relatively crude.

As well as being simple mechanically, the early laser shows tended to use separate small lasers, as powerful Krypton lasers were prohibitively expensive. So now for details of some modern Laser lightshows and their background.

Crystal Machine

Tim Blake (synthesiser player extraodinaire) joined the band Gong in 1972, he started using small Helium Neon (red) lasers for special effects during concerts. He teamed up with Patarice Warrener (technical boffin extraordinaire) and they called themselves Crystal Machine. The lasers used were replaced with slightly more powerful ones (2.5mW instead of 1.5mW) of the same type, most of the effects were produced by diffraction gratings, mirrors on loudspeakers and manual manipulation.

Crystal Machine left Gong and moved to Paris, with the loan of 6 new 20mW lasers (from Spectra Physics of California), they started mixing conventional light show techniques with Laser techniques. One memorable event was at a Parish church, with no place to hang a screen they projected an Argon (blue) laser onto the clouds to the sound of Tim playing his huge synthesiser bank! Crystal Machine also built laser light show equipment for Yes, and still performs as a total



sound light experience — one not to be missed if you get a chance!

Light Fantastic

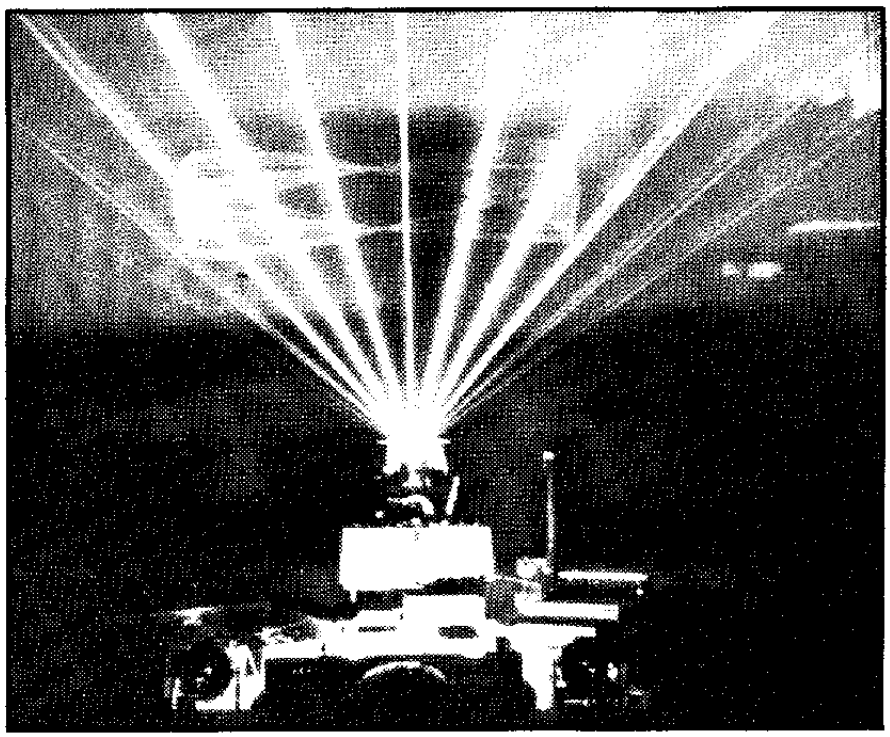
Was the name given to a recent exhibition cum laser show at the Royal Academy in London. This was mainly to let the public see the results of recent research in Holography and special laser effects by Nick Phillips, Anton Furst and John Wolff — collectively known as Holoco. The show consisted of dozens of Holograms, of different types, and an automated light show every 15 minutes — over the heads of the public — to the accompaniment of classical music. The main attraction for passing crowds, was the EttR symbols lased into the London sky over the Royal Academy.

Light Fantastic was a tremendous success with huge queues all the time, in fact it seems to have sparked off the recent upsurge in Lasers as good things to watch! John Wolff is also the technical manager for The Who, and has been using powerful lasers at their concerts for some time. His own show is due to open in August at the New London Theatre, using 9 lasers each 4W in power. In fact John probably has the biggest collection of lasing power outside of industry, some of his big (one new one is 60W) lasers vapourised the mirrors used to deflect them!

General Scanning

In 1975 Jean 'Coco' Montagu of General Scanning Incorporated, Massachusetts, became the first man to develop a Laser Projector capable of reproducing graphically alpha-numeric symbols as well as the more familiar and simplistic abstract patterns. He demonstrated this development in a dramatic way. Using his Laser Skywriter PCX101 the logo of the magazine Industrial Research was "written" on the clouds over Cambridge, Massachusetts, as were other graphics, including a 'flying-saucer'.

Since then General Scanning Inc. (who happen to be the main manufacturers of scanners in the world), have developed a unique type of laser projector. What makes this type of Laser Projector different and far in advance of other such Laser Projectors used in the field of Entertainment is that in addition to being able to describe abstract patterns and shapes it has the capability not only of creating alpha-numeric images but also moving line drawings of amazing diversity. At the time of writing no other Laser Image-Making Machine has quite the same advanced capabilities.



Top photograph was taken in Holoco studios, when they were preparing for the Royal Academy show "Light Fantastic". The EttR symbol was projected above the Royal Academy during the show. (Photo: Theo Bergström.)

On the left is a view of Crystal Machine in full flight, the massive synthesiser bank can be easily seen.

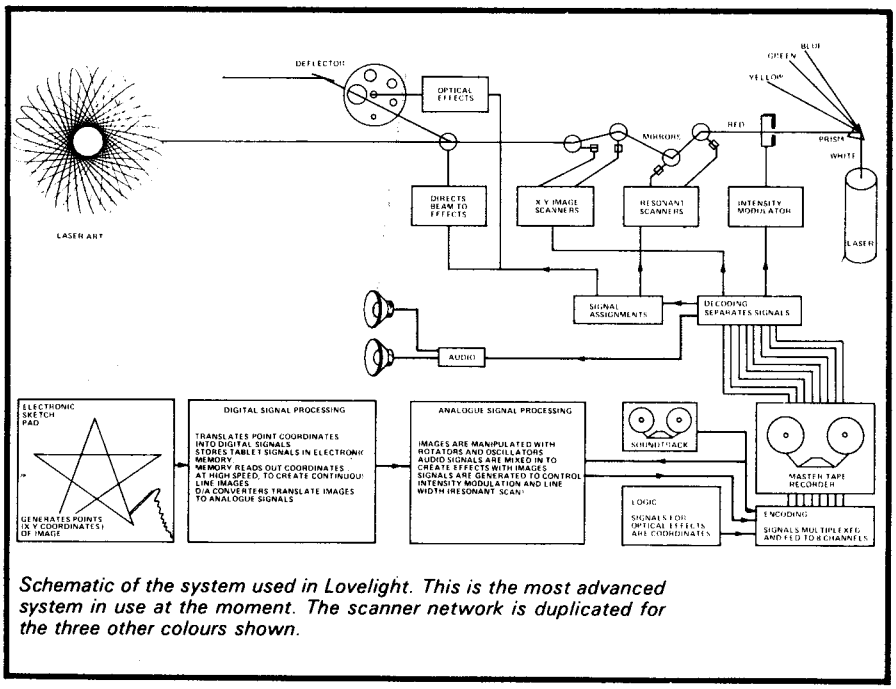
Lovelight

Realising the possibilities of the General Scanning machine, Gerd Stern — of Intermedia Systems — devised and produced Lovelight. With a team of over 50 people (technicians, artists and musicians) the master tape took about 9 months to produce. They literally had to start at the drawing board. The drawings were then processed via an X-Y pad into digital form, the basic system can be seen in the drawing on the left.

The original idea was to produce a laser musical, in fact they ended up with a tape and a machine — instead of a live production. The world premiere of Lovelight was on February 2nd 1977, at the Charles Hayden Planetarium in Boston, U.S.A.

The difference between Lovelight and all other laser shows is that graphics are projected as well as the spectacular effects produced by other systems. The colour photograph on our front cover is one such mixture, a spider climbing a laser web! A second machine was built and is being used in England, producing an identical show to its Boston twin. The English Lovelight is being staged at the Metropole Laser Theatre (formerly a cinema) in Victoria, London. This show is being put on by Laser Visuals Ltd in association with Rank Leisure Services Ltd and the American producers.

The Hewlett Packard instrumentation recorder has its 8 tracks multiplexed, to give an effective capacity of 32 information channels. The stereo sound track is recorded separately on a Teac 3340, with a third track providing sync pulses to keep everything together. The response of the resonant scanners (which provide control beam width and intensity) is up to a phenomenal 8kHz, the X-Y scanners have a more normal 2kHz response. This may not seem very impressive, but up until fairly recently controlled response up to 1kHz was difficult to obtain.



Schematic of the system used in Lovelight. This is the most advanced system in use at the moment. The scanner network is duplicated for the three other colours shown.

The laser used is made by Control Laser of Florida, and is a 1.2W Krypton/Argon type. A 42 foot diameter, parabolic aluminium screen is used as the projection surface (the largest ever built in England). Watching the show one has the same feeling that was probably felt by early cinema audiences. The overall effect is that of watching a computer generated animation film, but the figures are simple — even childish — in comparison to genuine computer animations. Nevertheless, it is an interesting experience, to be seen if you get a chance.

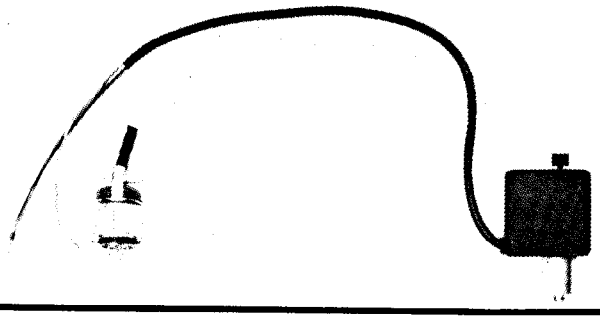
Laserium

Laserium was created in America by Ivan Dryer, a Californian film-maker and photographer, who developed the idea after seeing a laser projection technique demonstrated at the California Institute of Technology in 1970. He made a film of it (Laserimage) but recognised that film could not adequately capture the vivid effect of live laser beams. His years as a guide at the Griffith Observatory, Los Angeles, prompted him to choose a planetarium as the ideal environment and in 1971 he formed Laser Images Inc to explore the applications of lasers in entertainment.

Laserium was first presented at the Griffith Observatory in late 1973, since then it has been playing in 14 other centres, including Kyoto, Japan, where a specially constructed Laserium dome was opened in March 1976. Recently Laserium opened at the Planetarium in London as well.

The system used by Laserium is based around a 1W Spectra Physics Krypton laser.

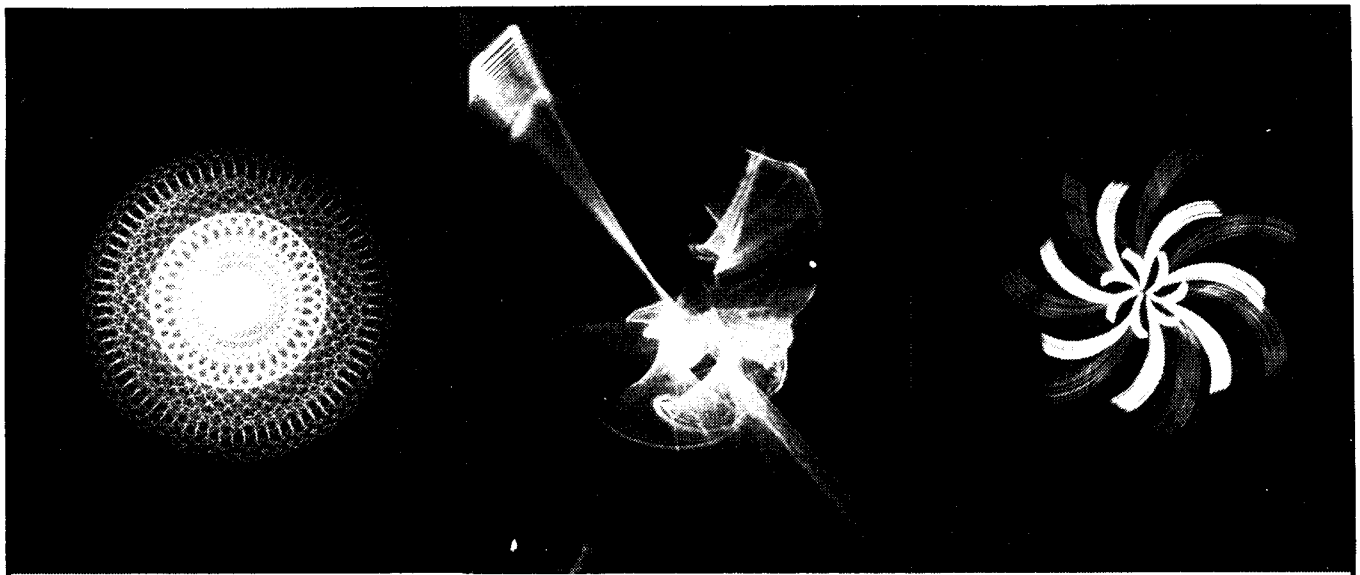
The greenish white beam is



A General Scanning G-100PD scanner as used by most of the systems described in the text, cost is about £400 for the standard model.

Scanners are mirrors mounted on galvonometers which describe a special and particular arc of rotation. The laser beam is guided into the mirror and thus reflected onto the projection surface. When the mirror moves, the laser beam is seen to move. The mirror movement is very rapid and the beam when deflected at anything over 20 times a second will appear to the viewer as a persistent and unbroken line, the path of the laser beam. At that speed of deflection our eyes can no longer perceive a single point of light.

With two mirrors mounted at right-angles to each other with perpendicular rotational axis, it becomes possible to guide the laser beams to any point in a two-dimensional field. This technique is known as X-Y scanning.



Three effects produced by the Laserium system. On the left is the basic type of geometric pattern produced by simple (but sophisticated!) X-Y scanning. Centre is the strange sort of effect produced when passed through a sheet of clouded glass, with deformation of the geometric pattern. Right is a "chopped" pattern, all of these patterns are continually changing.

passed through a prism, which splits the beam into red, yellow, green and blue beams. Each of these beams is processed via modulators, scanning mirrors etc, to produce multicoloured images on the Planetarium dome. Sound tracks and basic control signals are provided from a pre-recorded tape (played on a Teac 3340 four channel machine), but the main modulation signals are mixed and blended live, by an operator called a Laserist. Even though far less sophisticated than Lovelight's system, the effect is far more vivid, and no two performances are ever the same.

Other developments

So with all the laser shows at present, London seems to be the laser capital of the world. The only drawback to more people experimenting with similar systems is cost, most of the systems described have cost at least £100,000 and the laser itself is about £4,000.

However, if you fancy playing with lasers Holographic Developments Ltd may have the answer. They are developing a small ½mW laser for home use, which is expected to cost less than £200, also they are working on cheap scanning and effect attachments to stick on the end — the home laser light show may be just around the corner.

So lasers have become not only a tool for measuring, cutting, welding, and burning, but also an imaging device. As a contribution to visual displays and media, scanning projection is very appealing. These projections are not confined to a frame, as are film and television, nor to a particular projection surface. Lasers can be aimed at walls, clouds, balloons, or mountains, and can be safely used in indoor environments when not aimed directly at the audience, but reflected from a surface such as a planetarium dome.

Stop Press:

The Science Museum is staging a laser exhibition in November for three months — are lasers contagious?

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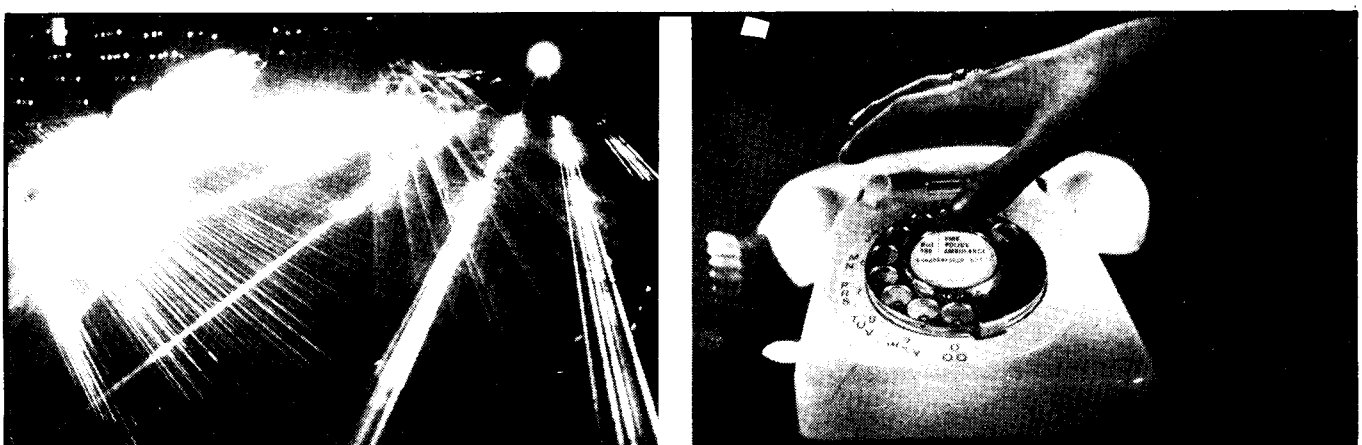

Left, part of a John Wolff show, of the type used in Who concerts. Right is a hologram shown at the Light Fantastic exhibition — the phone looked so real that some people tried to use it! (Both photos by Theo Bergström.)