

The Royal Photographic Society

HOLOGRAPHY GROUP

Newsletter December 1999

Professor Yuri Denisyuk pictured with Prof. Nick Phillips and Dr. Hans Bjelkhagen after receiving an Honorary Doctorate at De Montfort University.

Editorial

It seems only a few weeks since I was writing the editorial for our summer Newsletter, but now it's time to wish you all a merry Christmas, with plenty of spangly wrapping paper (courtesy of Applied Holographics), not to mention the dreaded dawn of Year MM.

Two events have marked the season: the award of an honorary doctorate by De Montfort University to Prof. Yuri Denisyuk, and the award of the Saxby Medal for progress in three-dimensional imaging for 1999 to David Burder. David was unfortunately unable to present his promised paper at our last Symposium owing to a late aircraft return from the States, but we have invited him to give a talk to the Group in the near future.

There are two important forthcoming events. One is some way away: a one-day symposium on Art in Holography, to be held in 2001, probably in the spring. The conference will be financially supported by a generous grant of \$5000 from The Shearwater Foundation, an American charity dedicated to fine-art holography. The second forthcoming event is in July 2000, the Holography 2000 Conference and Exhibition. This represents a continuation of the Triennial Symposium on Display Holography at Lake Forest, transplanted this time round to St Pölten, near Vienna. More in the Newsletter.

A sharp-eyed reader has taken me to task for adding a gratuitous acute accent to the name of Ernst Abbe in the last Newsletter. I can only reply "touché". I was probably listening to Liszt on the radio at the time. The same reader points out that the names and addresses of the Committee have not appeared in the Newsletter for some time. We do print them when there is space to spare, but recently the copy has filled an exact number of pages. You can always get in touch via RPS headquarters, of course.

We have been making steady progress with our Website, and Bob Gibson gives a progress report in this issue.

So, the very best to all of you for Christmas MCMXCIX, and may your MM hangover be a mild one!

Graham Saxby

Editor

Holography pioneer receives Honorary Doctorate from De Montfort University

Prof. Yuri Nikolaevich Denisyuk is nowadays no stranger to the West. Since he was awarded the RPS Progress Medal in 1987 he has visited Britain several times, most recently to receive an Honorary Doctorate from De Montfort University, Leicester. The University houses the prestigious Centre for Modern Optics, with research teams led by Prof. Nick Phillips and Dr Hans Bjelkhagen, so Prof. Denisyuk found himself in good company.

It is often said that when the time is right, there will inevitably be a significant step forward in science, and it may happen in more than one place. It certainly happened with Newton and Leibnitz evolving the calculus, and it happened again in optics around 1961-2, triggered by the invention of the laser. Emmett Leith in the USA and Yuri Denisyuk in the USSR were both working on coherent radar as a vital part of defence strategy for their respective countries. Both spotted the analogy with radar imaging of possible optical recordings using laser light. When the laser arrived, Leith, working with Juris Upatnieks, evolved the off-axis transmission hologram (see previous Newsletter), based directly on the principles of radar imagery. Denisyuk, on the other hand, combined ideas taken from the Lippmann photographic principle with an (unspecified) SF novel. The result was the single-beam reflection hologram. Denisyuk's personal courage in pursuing his work in the face of official (and unofficial) disapproval and disbelief stands out.

The Denisyuk hologram (he modestly called it a 'Lippmann hologram') has since acquired great importance in the policies of the great museums of St Petersburg, Moscow and Kiev: almost every artefact has a hologram made of it and exhibitions of these holograms tour the world. In his inaugural address, however, Prof. Denisyuk played this down, preferring to concentrate on his more recent work.

One of his interests, beginning in the 1980s, was a type of hologram which he called 'pseudodeep', or, later, a 'selectogram'; the technique produced the effect of an ultrathick emulsion by exposing holographic plates at near grazing incidence. Although this limited the parallax to one dimension, it offered reconstruction by diffuse light, and possibly the making of holograms without a reference beam. His most recent work is with nonlinear materials. Traditionally, photographs and holograms have been recorded on materials which have a near-linear response to variations in light intensity. A nonlinear response will produce a distorted output with a considerable second-harmonic component. In holography the effect will be as if the exposing light frequency were doubled, so

that the interference fringes are twice as close together, and the optical image will reconstruct with light of half the exposing light wavelength. At present this is pure research, but one can see possible applications of a record made by infrared and viewed by visible light.

Yuri Denisyuk has not had an easy life. As a teenage boy he survived the siege of Stalingrad, and no doubt the experience helped to shape the toughness of spirit which enabled him to survive the years of repression to become Head of the Laboratory of A F Ioffe Physical-Technical Institute and Academician of the Academy of Sciences in Russia. He has recently remarried, and we wish him well.

Holography 2000 Conference and Exhibition

The triennial Conference on Display Holography, previously held at Lake Forest College, Illinois, will take place this year in the Conference Facility of the Synagogue of St Pölten, Austria, from 10 to 15 July 2000. The city of St Pölten is roughly 50 km west of Vienna, and the organisers are arranging inexpensive accommodation (\$50—80). There will be receptions, cultural visits and a tour of vineyards. The conference fee is \$450, pre-registration (before 31 Dec) \$400.

The chairman will be Dr Werner Sobotka, and the co-chairs Tung H Jeong, Hans I Bjelkhagen and Margaret Benyon. The topics will include holography in art, recording materials, display holography, holographic imaging, applications, security, data storage and stereograms. Abstracts from intending contributors should be sent in by 1 Feb to Prof. Dr Werner Sobotka, Holography 2000, Herzogenburgerstrasse 68, A3100 St Pölten, Austria, fax no ++43 2742 313229, e-mail sobotka@fh-stpoelten.ac.at For entries for the exhibition contact Irmfried Wöber, Holotrend, Kahlenbergstrasse 6, 3042 Würmia, Austria, fax ++43 22 758281, e-mail holocenter.woeber@aon.at

Anybody requiring further information should contact Dr Sobotka by fax or e-mail. This is a big event for holography; so do tell any friends who might be interested.

Holograms from diode lasers?

The first diode lasers operated in the near infrared, between 900 and 1000nm. As the Agfa material had a little sensitivity in this region, some of us tried making simple holograms with them, but without much success. Now, diode lasers giving collimated red outputs of more than 5 mW are commonplace: you can get one from Edmund Scientific for under \$25. Like all lasers, they derive their monochromaticity from their two parallel faces, which act like a sort of optical echo chamber which resonates at only one pitch. The shorter the distance between the ends, the greater the coherence length, so, size for size, you might expect a diode laser to have a greater coherence length than a HeNe laser; but other factors affect the coherence length too, and the predicted figure is more like 40 mm. I tested a small laser diode on a Michelson interferometer some years ago and found this figure to be not far out. But the output wavelength was so sensitive to temperature that in practice I was able to rely on only about 2 mm, and the best I could do was a small bronze paperknife. It worked fine for copies, though.

But several papers have appeared recently that indicate differently. *Optics and Photonics News* for July 1999 contains an article by Raymond Ro, Masashi Iwasaki and Tung Jeong, no less, giving details of a holographic set-up using a VM65003 3 mW laser pointer from Midwest Laser Products without any kind of modification to make single-beam reflection holograms and interferograms. The coherence length is around a metre, after 20 minutes warm-up time. The Frank DeFreitas Holography Studio Netsite has information on holography using a 35 mW laser diode giving sufficient power for a 30 X 40 cm plate at 658 nm. This laser came from Power Technology, Inc., Little Rock, Arkansas. Frank thinks the laser was made by Hitachi. Along with driver and collimating optics the outfit costs around \$100. An average exposure for a 30 X 40 cm Agfa plate was 2 seconds. There is an illustration of a holographic image of coral that I would estimate at a depth of about three inches.

I talked about this to a representative of a company that imports many types of diode laser at the recent Photonex exhibition, but he felt that most diode lasers are far from reliable as far as wavelength stability is concerned. So if you are going to investigate this very promising field you need to tread carefully. All diode lasers are very sensitive to fluctuations in temperature, so you need to bear this in mind. If you have any experience in this field, please let us know.

Midwest Laser Products: tel 815 464 0085, fax -0767. <http://www.midwest-laser.com> DeFreitas: tel 610 770 0341. e-mail frank@holoworld.com
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Department of Partly-Baked Ideas

This time the column didn't make it into *holosphere*. The Museum newsletter was going through a bit of a crisis. None of the contributing editors had been paid for at least three issues back. The Editor was being replaced for almost every issue (probably because they weren't being paid either). The writing seemed to be on the wall for the Museum, and though it struggled on for another year or so, things seemed set to end in tears.

In my report I rhapsodised about the (then) new DPSS lasers, which put out 80 mW of green light at 532 nm with a coherence length of more than 3 metres, powered from an ordinary 13-amp socket and needing no special cooling. This had a few years earlier been a pipe-dream, as expressed in the preface to one of my earlier books. The price (some £15k) was *not* part of the dream. Since then the wattage has gone up and the price down. Solid-state lasers are undoubtedly the holographic light sources of the future, especially as they can now be made to emit wavelengths at single frequencies in the red, green and blue regions of the spectrum (to say nothing of IR and UV) and as either CW or pulse — and at less cost than their ionised-gas equivalents.

This got the DPBI to thinking about so-called pseudowhite lasers, which use mixed gases to produce a mixture of red, green and blue light, with mainly the printing industry in mind. Only too aware of the problems of persuading the beams from three separate lasers to squeeze through the same 10-micron pinhole, the DPBI had been watching the development with interest. At the time of writing, however, the coherence length of such lasers was, not to put too fine a point upon it, zilch (in contrast to the price).

It is in fact possible to manufacture a Fabry-Perot etalon that will resonate at several wavelengths, and, theoretically, to get a multi-frequency laser (such as a krypton-ion) to produce three appropriate wavelengths with full coherence. But nobody has done it yet. We still have to couple beams from three separate lasers to make a colour hologram, but we can now produce pulses at wavelengths that cover almost the entire CIE diagram area.

Graham Saxby

Website to support conference

The grant that we received from The Shearwater Foundation was given on the understanding that we would spend about half of it in direct support of the conference and the remainder on developing our website to bring the conference to the attention of a world-wide potential audience and to publish the proceedings on the World Wide Web. It is our intention to raise the profile of our website by including news items which will be frequently updated to establish a regular readership. We will use the website to call for papers for the conference and to advertise the event well in advance. Speakers will be encouraged to provide the text of their papers in machine-readable form and will be required to agree to subsequent publication on the World Wide Web. We will continue to publish the conference proceedings in hard copy for those who prefer this method or do not have access to the Internet. Those of you who have had anything to do with establishing a website will understand that there is a big difference between a simple domestic home page and the 'all singing and dancing' version that we are planning. We have a lot to learn but the process has already started and we should have something to show you next year.

Bob Gibson

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