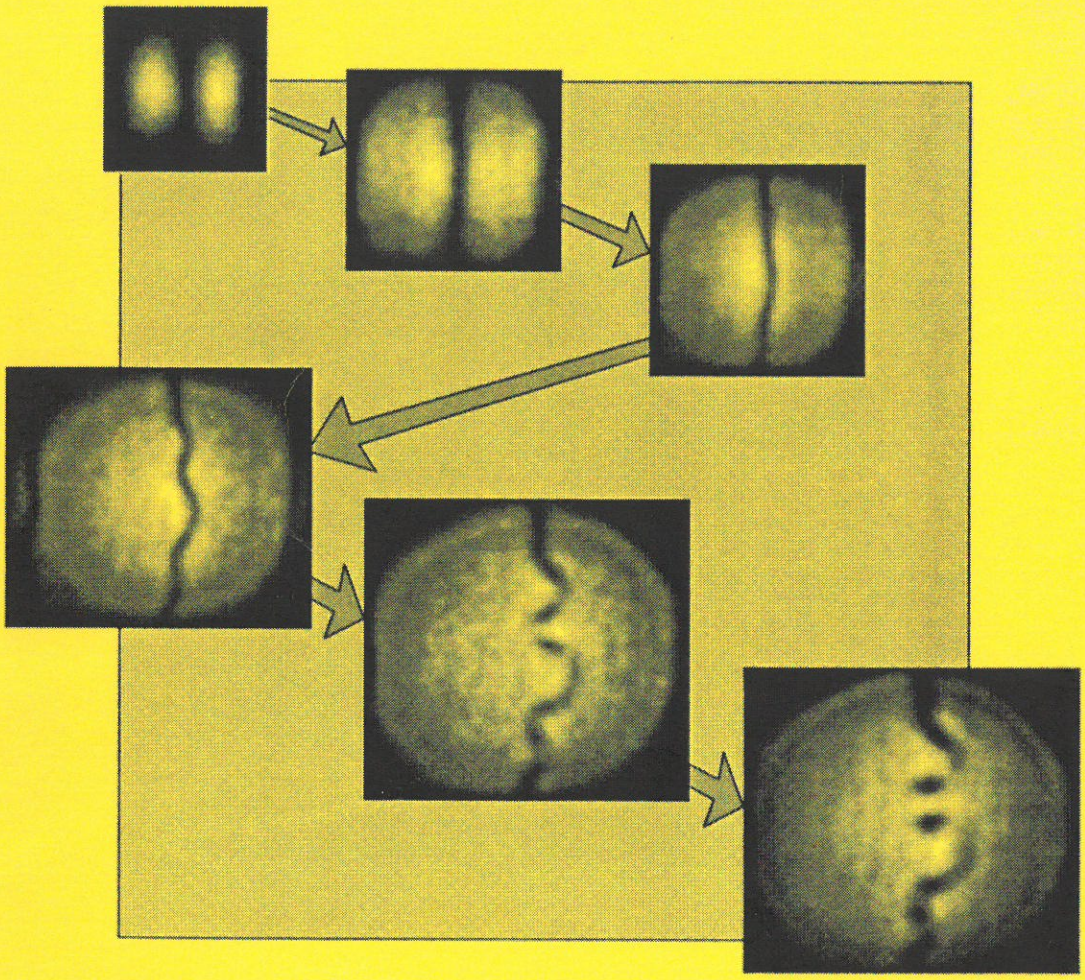
Australian Optical Society

NEWS



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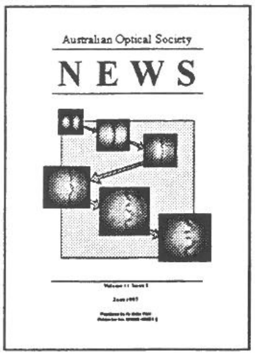
AOS NEWS

ARTICLES

DEPARTMENTS



COVER:
The evolution of a dark soliton stripe in a nonlinear medium. The initial beam (top left) contains a $\pi/2$ phase jump across its centre. With increasing nonlinearity the input stripe collapses to form a dark soliton stripe. This soliton develops a snake-like instability before breaking up to form a pair of oppositely charged optical vortex solitons (lower right).

Solitons may play a vital role in using light to control light in photonics applications (see the article on page 11).

SUBMISSION OF COPY:
Contributions on any topic of interest to the Australian optics community are solicited, and should be sent to the Editor or one of the Associate Editors. Use of electronic mail is encouraged, or else submission of hard copy together with an ASCII text file on floppy disk.

Where possible, diagrams should be contained within the document or sent as separate encapsulated post-script files. Figures on A4 paper will also be accepted.

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EDITOR
Duncan Butler
CSIRO Tel. & Ind. Phys.
PO Box 218
Lindfield NSW 2070
Tel: (02) 9413 7302
Fax: (02) 9413 7200
Email :
duncanb@dap.csiro.au

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7th August, 1997

***AOS News* is the official news magazine of the Australian Optical Society. The views expressed in *AOS News* do not necessarily represent the policies of the Australian Optical Society.**

AOS COUNCIL (1997/8)

PRESIDENT
Brian Orr
School of Chemistry
Macquarie University
Sydney NSW 2109
Tel: (02) 9850 8289
Fax: (02) 9850 8313
brian.orr@mq.edu.au

VICE-PRESIDENT
Halina Rubinsztein-Dunlop
Department of Physics
University of Queensland, QLD 4069
Tel: (07) 3365 3412
Fax: (07) 3365 1242
halina@kelvin.physics.uq.oz.au

SECRETARY
Clyde Mitchell
CSIRO Div. Mat. Science and Tech.
Private Bag 33,
Clayton South MDC, Vic. 3169
Tel: (03) 9542 2942
Fax: (03) 9544 1128
clyde.mitchell@mst.csiro.au

TREASURER
Barry Sanders
School of MPCE
Macquarie University
Sydney, NSW 2109
Tel: (02) 9850 8935
Fax: (02) 9850 8115
barry.sanders@mq.edu.au

PAST PRESIDENT
Chris Walsh
CSIRO Div. Telecomm.& Ind. Phys.
PO Box 218, Lindfield NSW 2070
Tel: (02) 9413 7156
Fax: (02) 9413 7200
cjw@dap.csiro.au

COUNCILLORS

Jesper Munch
Dept. of Physics and Maths
University of Adelaide
GPO Box 498
Adelaide SA 5001
Tel: (08) 303 4749
Fax: (08) 232 6541
jmunch@physics.adelaide.edu.au

Ken Baldwin
Laser Physics Centre
Research School of Phys. Sci. and Eng.
Australian National University
Canberra ACT 0200
Tel: (06) 249 4702
Fax: (06) 249 0029
Kenneth.Baldwin@anu.edu.au

Esa Jaatinen
CSIRO Div. Telecomm.& Ind. Phys.
PO Box 218, Lindfield NSW 2070
Tel: (02) 9413 7269
Fax: (02) 9413 7200
esaj@dap.csiro.au

Chris Chantler
School of Physics
University of Melbourne
Parkville VIC 3052
Tel: (03) 9344 5437
Fax: (03) 9347 4783
chantler@physics.unimelb.edu.au

Ann Roberts
School of Physics
University of Melbourne
Parkville VIC 3052
Tel: (03) 9344 5038
Fax: (03) 9347 4783
annr@muon.ph.unimelb.edu.au

Peter Farrell
Optical Technology Research Laboratory
Department of Applied Physics
Victoria University
PO Box 14428, MCMC Melbourne
Tel: (03) 9688 4282
Fax: (03) 9688 4698
peterf@dingo.vut.edu.au

Lew Whitbourn
CSIRO Div. Exploration and Mining
PO Box 138
North Ryde 2113
Tel: (02) 9887 8602
Fax: (02) 9887 8921
l.whitbourn@dem.csiro.au

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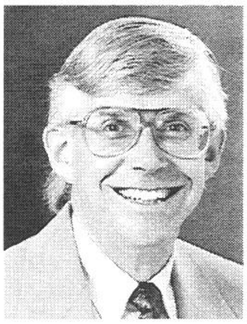
(The International Society for Optical Engineering)

President's Report

by Brian Orr

(Presented to the Annual General Meeting of the Australian Optical Society, 2 May 1997)



My term as President began last July on the final day of the highly successful IQEC'96 conference, in which the Society participated enthusiastically. The subsequent ten months have been largely devoted to fostering communications, on various fronts and through various media.

Communications on the international front have been skilfully coordinated by Ken Baldwin. A mutually advantageous agreement has been renewed with the Optical Society of America and a corresponding agreement with SPIE is (hopefully) in the final stages of negotiation. Other communications include those with the International Council on Quantum Electronics (ICQE), the International Commission for Optics (ICO) and various organisations covering the Asia/Pacific region. On the local scene, we maintain a close affinity with the Australian Institute of Physics, contributing to mutually relevant strategic plans and providing joint membership discounts for our members. Moreover, we have recently made a preliminary submission to the Australian Research Council with the objective of preserving Optics as one of the ARC's Priority Areas, as has been the case during the current three-year period.

Our regular communications with the Federation of Australian Scientific & Technological Societies (FASTS) are evident from its newsletters reprinted in *AOS News*. FASTS is a lobby group aiming to promote the potential of Australia's science and technology in local political, social and economic circles. I represented the Society when the FASTS Council met in November to formulate its "Ten Top Policies" for Australian science and have been following its subsequent reporting to the government's Stocker and West reviews. In March, one of our student members, Kylie Waring, attended the FASTS Careers Symposium in Canberra.

Duncan Butler has continued his excellent service as Editor of *AOS News* - our quarterly journal. This is one of the Society's main channels of communication, providing members with a combination of optics-related articles, news, professional society issues and commercial information. AOS Council has been discussing the advantages of establishing an Editorial Board for *AOS News*, to enhance the status of contributed scientific / technical articles. We also have Duncan to thank for the AOS Web site - a mine of information - to be found at:

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http://www.dap.csiro.au/OPTECH/
Optics-Radiometry/aoshome.htm
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While communications are important to the AOS, they alone cannot justify our existence: we are opticists, so we must actively advance that craft. Today's AOS "mini-symposium" (which, incidentally, has received a very healthy response, with a lecture theatre full of eager opticists) recognises that need to a degree. The next big opportunity for us to share our scientific progress will be the AOS XI conference in Adelaide (10 - 12 December) which is being organised by Jesper Munch and his colleagues (see the AOS Web site for more information). Beyond that lies AOS participation in the ACOLS'98 conference, likely to be held in Christchurch, New Zealand in December 1998 - our first "off-shore" meeting.

The AOS owes its existence to a succession of dedicated people who have been our office bearers and/or Councillors; the current Council is no exception. One to be singled out on this occasion is Esa Jaatinen who has served the Society calmly and capably as Treasurer for the last two years. Esa will depart from that role at this Meeting, leaving our finances and membership in a healthy condition. He and others who are stepping down from the AOS Council deserve our praise and gratitude and those who succeed them should be welcomed and encouraged to keep up the strong AOS tradition.

My final point concerns the annual AOS Awards. The applications and nominations received this year were disappointingly few in number (indeed, no applications were received for the Technical Optics Award) but of a remarkably high standard. Tanya Monro (Sydney University) has been selected to receive the 1997 AOS Student Prize. It is now my pleasure to conclude with the announcement that the AOS Council has agreed to award the prestigious 1997 AOS Medal to one of our most distinguished members, Professor Jim Piper of Macquarie University.

Brian Orr
School of Chemistry
Macquarie University
Sydney NSW 2109
Tel: (02) 9850 8289
Fax: (02) 9850 8313
Email: brian.orr@mq.edu.au

AOS MEDAL

1997 Winner

We are pleased to announce that Professor **James Austin Piper** of the Centre for Lasers and Applications at Macquarie University has been selected as this year's winner of the AOS Medal.

The AOS Medal is the highest award of the Australian Optical Society, and is awarded every one or two years to a nominee at an advanced stage of his or her professional career with a strong and sustained record of authority, enterprise and innovation in the field of optics in Australia. Previous winners of the award have been the late Bill James of James Optics Pty. Ltd., in Melbourne, and Dr Parameswaran Hariharan, of the University of Sydney and CSIRO.

After completing his PhD degree at the University of Otago, New Zealand, Jim Piper went to the Clarendon Laboratory in Oxford for four years of post-doctoral research. He then took up a position at Macquarie University, where he built up a large group researching the physics of a wide variety of lasers. Much of this work, especially in the area of high power copper lasers, is recognised as the internationally leading work in the field. Following his appointment nine years ago as Director of the Centre for Lasers and Applications, Professor Piper has had the opportunity to broaden the research into areas of solid-state lasers, laser applications and optical systems development, and to set up important international collaborations. He has published about 120 refereed papers and presented a similar number of international conference papers. In addition to his impressive research record, Professor Piper has established a University degree course with a strong emphasis on applied optics, and has also displayed entrepreneurial and management skills of very high order. He is a former President of the Australian Optical Society and a winner of both the Pawsey Medal of the Australian Academy of Science and the Walter Boas Medal of the Australian Institute of Physics. Three years ago he was elected to Fellowship of the Optical Society of America.

At its meeting in Sydney on 2 May 1997, the AOS Council gladly and unanimously endorsed the recommendation of the selection panel that Professor Jim Piper be awarded the AOS Medal this year. The presentation will take place at the AOS XI Conference in Adelaide in December.

Optical Guided Waves and Applications

The **Australian Photonics Cooperative Research Centre** is holding a meeting on **Optical Guided Waves and Applications** at the ANU, 9-11 July 1997. This meeting is open to all researchers working in the any area of theory, experiment or application. There will be a small number of invited talks covering fibre gratings, fibre sensors, photorefractive effects and nonlinear devices.

Further details can be obtained from :

Helen McMartin
Tel (06) 249 0693
Fax (06) 249 0029
e-mail: hjm111@rsphysse.anu.edu.au.

OPTICS GRAPEVINE

News from the World of Optics

AUSTRALIAN OPTICAL SOCIETY

AOS X1

Adelaide

10-12 December, 1997

AOS members should have received the first notice by mail.

To visit the conference Web Site, follow the link from the AOS:
http://www.dap.csiro.au/OPTECH/Optics-Radiometry/aoshome.htm

Comings and Goings:

Professor **Jacob Stamnes** (author of *Waves in Focal Regions*) from the University of Bergen was recently in Australia to work with Colin Sheppard.

Professor **Yoshiaki Nakano** is visiting the CSIRO Division of Telecommuncations and Industrial Physics (DTIP) for one year. Prof. Nakano lectures in physics at the Hokkaido College of Pharmacy, Japan, and has recently been working in the area of Talbot interferometery. Whilst at CSIRO he will be working with David Farrant and Bob Oreb on electronic speckle pattern interferometric profiling.

Kiofumi Matsuda is visiting Sydney University for three years. Kiofumi is from Mechanical Engineering Laboratory, Tsukuba, Japan. He will be working with Colin Sheppard, and also plans to spend a few days a week working at CSIRO DTIP.

The AOS has a new treasurer, **Barry Sanders**, who took over the reigns from **Esa Jaatinen** at the last AGM.

The 1997 Australia Prize

Allan Snyder
Rodney Tucker
Gottfried Ungerboeck

The three winners of this year's Australia Prize have helped to make the world a smaller and more interesting place by playing a crucial role in the advent of the information superhighway. Science and Technology Minister, Peter McGauran has praised Professor Allan Snyder, Professor Rodney Tucker and Dr Gottfried Ungerboeck for their major contributions to modern telecommunications.

"All three scientists, two Australians and an Austrian, have played a pivotal role in establishing the modern international telecommunications network." "Take away the contribution of any one of them and the network would be inferior," Mr McGauran said. "Professor Snyder, Head of the Australia National University's Optical Sciences Centre, confounded the sceptics and gave industry access to ground-breaking technology by providing the cornerstone research of the optical fibre telecommunications network.

"In developing laser technology to increase the network's carrying capacity by ten-fold, Professor Tucker, Head of Melbourne University's Photonics Research Laboratory, produced results previously only dreamed of.

"And without IBM research scientist, Dr Ungerboeck's discovery of the breakthrough coding system which enables high speed data transmission, the telcommunications revolution would have stalled long ago." "They are, all three, giants of telecommunications research and very deserving of their Australia Prize," Mr McGauran said.

The winners will share $300,000 and each will receive an inscribed medal.

The Australia Prize, which has helped boost Australia's stocks in world science, is for researchers who have made outstanding contributions to science and technology promoting human welfare. The research category changes each year. Next year's award will recognise scientists working in the field of molecular genetics.

(Taken from a media release from the Hon. Peter McGauran, MP Minister for Science and Technology)

AUSTRALIAN OPTICAL SOCIETY

POSTGRADUATE STUDENT PRIZE

A. Preamble
The Australian Optical Society wishes to encourage participation in national and international conferences by high-quality postgraduate students. To this end, the Society has instituted an award, the Australian Optical Society Postgraduate Student Prize. This will take the form of a grant to assist the grantee to attend a conference in optics or a related field. For 1998, the award will be valued at up to $1500. The Society now invites applications from suitably qualified people for this prize for 1998.

B. Prerequisites
An applicant must be: (1) a citizen or permanent resident of Australia, (2) a member of the Australian Optical Society, (3) enrolled in a postgraduate research degree in Australia at 31 October 1997, with a project in an optically related area. Non-members of the AOS may join the Society concurrently with their application for the prize. (Application forms are available in *AOS News*, or may be obtained from the Treasurer or Secretary). The prize cannot be awarded more than once to any individual.

C. Selection criteria
An applicant must be sufficiently advanced in the research project to have obtained significant results in optics or a related area, such that those results are suitable for presentation at a proposed conference that falls in the twelve month period commencing 1 December 1996. It is expected that the presentation at the proposed conference would take the form of a research paper, invited or contributed, oral or poster. The successful applicant will be expected to write a summary of the conference for *AOS News*.

Preference will be given in the selection procedures to applicants who intend to use the prize to attend and present their research results at a major conference outside Australia or New Zealand.

It is not essential that the results to be presented should already have been accepted for presentation at the proposed conference at the time of application, but no payment of the prize will be made until evidence of such acceptance is provided to the Society. Applicants are encouraged to provide tangible evidence of the results likely to be presented at the proposed conference (for example, in the form of an outline of a paper that has been accepted or submitted or is being prepared for that conference) and to make clear the benefits that would arise from their attendance at that conference.

The AOS award is not intended to cover the full cost of the applicant's attendance at the proposed conference. Wherever possible, applicants should identify means by which their research group and/or institution is likely to make a substantial contribution to their travel costs. Evidence of any such supplementary support should be provided (for example, by an undertaking in the supervisor's letter of recommendation). However, students with no identifiable supplementary travel support will not be disadvantaged in the selection process.

Since the research supervisor's report is a major factor in the assessment process, supervisors should be prepared to rank their students against the selection criteria if contacted by the selection committee.

D. Application Details

1. Curriculum vitae;
2. List of publications, conference papers, theses, reports, etc.;
3. Details of postgraduate research project;
4. Details of proposed conference (including its status and relevance to optics);
5. Details of participation in the conference (nature of contribution as specified above);
6. Details of predicted expenses, as well as other (probable or confirmed) sources of funding for attendance at the conference;
7. Reports from the candidate's research supervisor and one other referee;
8. Statement that the candidate is a citizen or permanent resident of Australia;
9. Statement of agreement to write a summary of the conference for *AOS News*.

Applications should be sent to the Secretary:

Dr Clyde Mitchell
CSIRO DMST
Private Bag 33
Clayton South
Victoria 3169

and **must be received by 31 October 1997**. The winner will be announced early in 1998.

On the 19th of March the NTEU (National Tertiary Education Union) and FASTS sponsored a one day forum in Canberra, intended to highlight the lack of career structures for younger scientists engaged in research. The AOS assisted Kylie Waring in attending -ed.

From Physicist to Poppy King*, Overnight?

The forum title was appealing: "In the National Interest: Putting the Talent to Work." We all arrived, bright eyed and bushy tailed, to see what we could do for our careers as young scientists.

The forum started with the stories of two PhD graduates: Dr Catherine Elliott, a geologist, who, because of the sexism that she faced in the mining industry, set up her own consulting business, and Dr Michael Pegg, a biochemist, who after 9 contracts in 9 years working on the flu vaccine, had taken the role as an NTEU research officer. Their stories highlighted some of the difficulties faced by science graduates in forging a career and the list was not encouraging. For example, where do maternity and long service leave fit into a short term contract? How do you apply for a 3 year grant if you don't know where you'll be after one year? What about superannuation? How do you cope with not learning if you will be employed for another year until the week before Christmas?

A suggestion was made during question time that pay levels could be increased for contract workers to make up for the lack of conditions. This may have some merit. The issue of sexism in the mining industry also attracted attention during question time: a mining industry representative assured us that it didn't exist any more. The responses of several women in the audience said otherwise, with some alarming stories.

The next session dealt with the skills of scientists: do we have the skills required to survive in the current environment? Dr Doreen Clark, Managing Director of the chemical analysis company that she started around 20 years ago, stated that she looked for a "bright eye and an active mind" when employing staff. She also requested that universities teach the principles of science, rather than just the facts. Dr Michael Buckenham, President of the Australasian Institute for Mining and Metallurgy, expressed concern that courses that were mining industry specific, are disappearing. Graduates are not gaining information about the mining industry, and are not choosing it as a career option. Unfortunately, this session did not touch on the topic of scientists surviving in the business world with their current skill levels.

Then on came the politicians: the Minister for Science and Technology, Peter McGauran, told us that scientists have established a good working relationship with government over the years, and for us not to ruin it by "whingeing and whining." We were then told that PhD numbers in science were up, and that this indicated a healthy attitude to science. There was no question time for this session, so we couldn't ask about follow through funding to provide jobs for these PhD's.

The lunchtime session speaker was Professor Ian Lowe, who made the most of Science Minister's comments, using them as the basis of an argument for more funding for science. He told of the declining government spending (despite the Science and Technology Budget statement recognising that innovation was vital to the economy), and that both Australia and New Zealand had very low levels of industry investment in research. Researchers in some of our nearest neighbours, Singapore, South Korea and Taiwan, are better paid and benefit from increased industry funding.

The afternoon session looked at solutions to the limited academic career prospects facing most PhD graduates. Speakers Professor Peter Cullen (Cooperative Research Centres), Dr Janice Hirshorn (Australian Pharmaceutical Manufacturers Association) and Graham Mann (Past President, Australian Society for Medical Research) all provided advice and insights. In order to survive, we would need to be innovative, market ourselves (know the market), recognise that tenure is a thing of the past, demonstrate a wide range of skills (not just scientific), and widen our horizons by going into industry or starting a small business. We were told of the highly successful "factor F" program for the pharmaceutical industry, which strongly encouraged industry investment in research. The overwhelming opinion was that government funding is not going to improve in the short term, and somehow, industry has to come to the rescue.

But, what hope does all this really offer us? Are jobs in industry or small business really the answer? After all, the small business success rates are around 20% (comparable to ARC grant success rates!), while few industry jobs seem to require physicists. And what happens to basic research in all of this? While academia may not be the ideal career path, the other alternatives do not necessarily offer much more in return. Well, I guess there's always the option of leaving physics, becoming a merchant banker and having a laboratory in the back yard!

Kylie Waring
Laser Physics Centre
Research School of Physical Sciences and Engineering
The Australian National University
Canberra ACT 0200

*Poppy King was Young Australian of the Year several years ago, and received a lot of publicity about her business success earning her millionaire status.

AOS Technical Optics Award

Call for nominations for *1998*

This award recognises those who have made a significant achievement in technical optics, not necessarily in a manner manifested by an extensive academic record or a traditional academic reputation. The work for which the award is made must have been carried out principally in Australia.

Applications are encouraged from, but not restricted to, young optical workers.

The winner will receive a prize consisting of $300 cash, one year's free membership of AOS, and an invitation to attend the AOS conference and make an oral presentation of his or her work.

Nominations are now invited from (or on behalf of) suitable candidates for the 1997/8 award, which will be presented at the next AOS Conference (planned for Adelaide in early December 1997).

Details of the applicant's or nominee's activities and achievements should be sent to the Secretary:

Dr Clyde Mitchell
CSIRO DMST
Private Bag 33
Clayton South
Vic. 3169
Fax: (03) 9544-1128

to be **received by 30 November 1997**.

Editorial

This issue is the first since the formation of an editorial board to control the *AOS News*. The board (listed on page 2) is responsible for the content of this magazine, and replaces the previous editor/associate editor system. The change was approved at the last council meeting, and is intended to ensure the scientific quality of *AOS News*, as a prerequisite for obtaining DEETYA classification for published articles (at the "professional magazine" level). Although the DEETYA classification scheme is in a state of flux, this move should help authors get some benefit from the work they put into articles published in the *AOS News*.

Despite the changes, articles and other correspondence for the *AOS News* should still be addressed to the editor.

In this issue there are advertisements for the AOS Postgraduate Student Prize, worth $1500 for travel, and the AOS Technical Optics Award, worth $300. I encourage you to apply for these awards if you are an appropriate candidate — they are well worth the effort involved in making an application, and, if you are soon to be in a job-seeking situation, they are a great way to make your CV stand out from the crowd.

I am indebted to the authors of the scientific articles for this issue — both of whom were very busy with work commitments around the deadline. Barry Luther-Davies has written about the use of solitons in photonics, and Esa Jaatinen has described the problems of frequency instability in lasers, and discussed several methods of active frequency stabilisation.

Also in this issue are some reports of recent events in optics. In particular, there is a brief report on the council meeting and AGM held in May, and the 'Mini-Symposium' held on the same day. The retiring treasurer, Esa Jaatinen, has written a summary of the society's accounts which is reproduced at the end of the magazine.

Duncan Butler

AOS MINI-SYMPOSIUM MACQUARIE UNIVERSITY SYDNEY

2 MAY 1997

The AOS held a "Mini-Symposium" in early May to provide an opportunity for several "mid-career" scientists working in various areas of optics to present their work, and also as a means of generating interest in the society's Annual General Meeting, which formed part of the proceedings. The occasion was attended by approximately sixty people. The afternoon's events were preceded by a meeting of the AOS Council, a summary of which is presented elsewhere in this issue.

The first speaker for the afternoon was Dr Martijn de Sterke, of the Department of Theoretical Physics at the University of Sydney, whose talk was entitled "Nonlinear optics in gratings". Martijn's talk discussed the behaviour of light propagating in fibres containing grating structures. At certain frequencies, the propagating light has a group velocity much lower than that in untreated fibre, but the dispersion is also very large, leading to substantial pulse broadening. However, at high intensities non-linear effects in the glass produce a "glue-like" effect which keeps the pulse together. This has been shown both experimentally and theoretically.

The AGM was held next. Following the acceptance of apologies and the minutes of the previous meeting, the President, Professor Brian Orr, presented his report, which is reproduced separately in this issue of *AOS News*. The report of the Treasurer, Dr Esa Jaatinen, is also summarised elsewhere in this issue: the bottom line is that there is currently a good balance between the Society's income and expenditure. A motion was passed confirming the re-appointment of the auditor, E.P. Groombridge and Co. The meeting moved on to the election of office bearers and councillors.

Esa Jaatinen wishing to stand down from the office of Treasurer, Dr Barry Sanders was elected unopposed in his place. Dr Esa Jaatinen was elected to a place on council, replacing the retiring Dr Kieran Larkin. Dr Peter Farrell was elected to a further term.

After afternoon tea, the scientific aspect of proceedings was taken up again by Dr Peter Fisk, of the CSIRO National Measurement Laboratory, Sydney, with a talk entitled "Optics in timekeeping". Speaking about his research on precise frequency measurements using trapped ions, he described recent developments in atomic clock technology. These included the possibility of optical clocks, and the realisation of clocks based on cold laser-cooled atoms and ions. He summarised recent progress in this area at the National Measurement Laboratory.

The final scientific presentation of the afternoon was a talk entitled "Asymptotics for optics" by Professor Greg Forbes of Macquarie University. Discussing the problems that arise from singularities in conventional models light propagation, he showed how a globally valid asymptotic field estimate follows from consideration of the Fractional Fourier Transform of a field. He also pointed out that this new formalism suggests a different interpretation of the geometric rays of optics. These ideas are the subject of his group's current research.

NOTES FROM THE COUNCIL MEETING MACQUARIE UNIVERSITY SYDNEY

2 MAY 1997

As usual, the council meeting, held just before the Mini-Symposium at Macquarie University on 2 May, faced a very full agenda. The President's and Treasurer's Reports will appear elsewhere in *AOS News*. It was agreed that unemployed persons would be eligible for membership at student rates, but must reapply for this status each year that they remain unemployed. (This benefit does not extend to retired members). We were sorry to lose the services of Esa Jaatinen from the office of Treasurer: a motion of gratitude to Esa for his services during his two terms of service was moved from the Chair and passed unanimously. We welcome Barry Sanders, who was elected Treasurer at the AGM, and hope that he will enjoy the challenge of this office.

The difficulty of discussing a wide range of issues has in recent years been greatly alleviated by the use of e-mail, although the extent to which council business could be conducted in this way remained an open question. Council decided that decisions could appropriately be made and acted upon as a result of a consensus obtained by e-mail, although any such decision must be recorded, and tabled and ratified at the next meeting.

There was some discussion about our membership of FASTS, the Federation of Australian Scientific and Technological Societies, of which AOS is a member. Although this membership is a significant cost to a small society like ours, it was agreed that there were substantial benefits in belonging, and no change was proposed. It was suggested that members might be informed on their renewal slips that their membership fee includes $4.50 for FASTS.

Council moved on to consider our relationship with international bodies, most importantly with OSA and SPIE, with whom we are re-negotiating the agreements which provide discount membership for AOS members. There are no major problems with the OSA agreement,

and it is expected that it will be signed at CLEO '97 in Baltimore in May. Matters are not so far advanced with the SPIE agreement, there being still a few issues which need to be "ironed out" before an agreement can be finalised. Council authorised Ken Baldwin, our International Liaison Officer, to continue negotiations with both organisations. A formal statement of the role of International Liaison Officer was also proposed and accepted by Council.

Regarding future conferences, the possibility of a CLEO/Pacific Rim meeting in Australia in 2003 was raised. Also, the year 2001, which would be an AOS conference year, may also be the year of the International Laser Spectroscopy Conference. The very large CPEM conference planned for Sydney in 2000 was also drawn to Council's attention.

Interactions with the Australian Institute of Physics continue to be regarded as very important, and a subcommittee was set up to ensure that optics is adequately represented in the forthcoming strategic plan. Ken Baldwin was endorsed as the representative for AOS on the National Committee for Physics. We have to consider how much effort to put into producing a submission to the ARC, with a view to maintaining the status of optics as a priority area: it was resolved to make an "efficient submission" to ARC in this regard. Keith Nugent and Halina Rubinsztein-Dunlop were appointed AOS representatives on the ACOLS Liaison Committee. Council noted the very inclusive web page devoted to the forthcoming AOS XI Conference in Adelaide (December). It is at

http://bragg.physics.adelaide.edu.au/~mwh/aosmeet/aosmeet.html.

Several issues relating to invited speakers, the financial plan, and DEETYA regulations about classification of publications were discussed.

In December 1998, the ACOLS Conference will be held in Christchurch, New Zealand. It was agreed that this will also be the major AOS conference for 1998. The ACOLS Liaison Committee will have a strong Australian bias to counter the country's limited representation on the conference organising committee.

As reported elsewhere in this issue, council unanimously approved the award of the 1997 AOS Medal to Professor Jim Piper of Macquarie University's Centre for Lasers and Applications. Council also noted with approval the award of the Postgraduate Student Prize to Tanya Monro. Unfortunately, there were no applications received for the Technical Optics Award.

Council moved to set up an Editorial Board to ensure the scientific quality of *AOS News*, as a prerequisite for obtaining DEETYA classification for published articles (at "professional magazine" level). Council did not feel it was either appropriate or practicable to implement a peer review process for publications in *AOS News*. An ISSN number is to be obtained for the publication. The Editor of *AOS News* has a standing invitation to attend all AOS council meetings. The extent of free advertising provided to Corporate Members in *AOS News* was considered, and it was felt that some of this could appropriately be replaced by the provision of a link (with a disclaimer) to advertising material on the World Wide Web. Council thanked Duncan Butler for his excellent work as editor of *AOS News* and for his provision of our high-quality website.

Spatial Solitons and Photonics

Barry Luther-Davies
Australian Photonics Co-operative Research Centre, Laser Physics Centre
Research School of Physical Sciences and Engineering,
The Australian National University, Canberra ACT 0200

Spatial solitons are "stable" beams of light which propagate through a nonlinear material without spreading. The intensity distribution of the light does not change on propagation: a property these soliton beams share with the field contained in an ordinary optical waveguide. This link between guided wave optics and spatial solitons suggests these solitons may be useful in photonics, and indeed much research focuses on their application to optical switching.

1. Introduction

Optical nonlinearity will be a familiar concept to anyone who uses second harmonic generation or optical parametric amplification – second order nonlinearities – to change the frequency of a laser source. In many cases these second order effects, which rely on a component of the polarisation of the field in the material being proportional to the square of the driving field, are spectacularly large. Second harmonic generation with an efficiency of more than 70% is relatively common. However, higher order nonlinearities (polarisation is proportional to the third and higher powers of the field) are not used as much, generally because the magnitude of the nonlinear response decreases with increasing order, and these higher order effects are rather small.

Nevertheless, those of us who have been engaged in the construction of very high power solid-state lasers are well aware that glasses and laser crystals can be destroyed by the process of self-focusing and filamentation. In this process, the third order nonlinear response of the medium leads to a lensing behaviour which causes a beam to spontaneously focus. The very high intensity in the self-focused spot can lead to optical damage of the laser medium in the form of "angel hair" (streams of microscopic laser damage bubbles).

2. Bright Solitons

For a monochromatic field we can write the polarisation of the medium in the form:

$$P = \chi_0 E + \chi_2 E^2 + \chi_3 E^3 + \ldots \qquad (1)$$

where E is the electric field vector and χ is the strength of the nonlinearity. We see that the third term can be written:

$$\chi_3 E^3 \propto \chi_3 I E \qquad (2)$$

where I is the optical intensity. This introduces an intensity dependence to the refractive index of the medium. Thus, if the coefficient describing the third order nonlinearity is positive, an increase in light intensity leads to an increase in the refractive index. A Gaussian beam will thus induce a higher refractive index on-axis than at its edges, and will thus experience a focusing action in the medium.

The immediate question to ask is; Can the strength of the focusing action be such that it exactly balances diffraction, thereby creating a stable beam? The fact that the answer can in some circumstances be "yes" is the foundation of all research into optical spatial solitons.

When the answer can be "yes" depends on a number of factors relating to the type of soliton being excited and the nonlinearity of the medium. The nonlinearity described by (2) above is known as Kerr-like and is characterised by a change of refractive index *linearly* dependent on intensity. For Kerr nonlinearities, beams whose intensity varies in only one transverse dimension, known as (1+1) dimensional beams (and approximated by a beam in a planar optical waveguide) can form stable bright solitons. On the other hand, beams whose intensity varies in both transverse directions (known as (2+1) dimensional beams) are unstable and undergo catastrophic self-focusing. This results in optical damage to the medium as mentioned above. The run away behaviour, which occurs because the focusing action is always stronger than diffraction, can be prevented if the non-linear response of the medium saturates. That is, the refractive index change does not increase above a particular intensity, limiting the maximum "strength" of the lensing action. Thus, experimental work on two dimensional spatial solitons relies on the use of media with saturating nonlinearities.

3. Dark Solitons

So far I have only mentioned spatial solitons in the form of localised beams – bright spatial solitons – which are easily imagined as non-diffracting "laser" beams and are created in self-focusing media. Another type of soliton exists, the dark spatial soliton [1], which is created in self-defocusing materials (that is a material whose refractive index decreases with increasing intensity). Dark spatial solitons, as their name implies, are stable regions of darkness within a plane wave

background beam. Both (1+1) and (2+1) dimensional structures exist – (2+1) dimensional structures being known as optical vortex solitons.

To understand the nature of a dark spatial soliton, one should simply ask how any stable dark region can be created at some point in an otherwise bright plane wave background beam. This can be achieved by ensuring that the radiation on opposite sides of the dark zone has equal intensity but is phase shifted by π. Thus, as energy diffracts towards the dark zone the contributions from the opposite sides undergo total destructive interference and the field amplitude is fixed at zero. A dark soliton where the phase of the wave on opposite sides differs by exactly π is called a "black" soliton. These dark structures can be created in linear media and hence the nonlinearity simply acts to counteract diffraction stabilising the width of the dark zone.

One might ask what happens if the phase shift differs from π? In this case dark solitons still exist but they become "grey": that is the intensity at their centre does not go to zero because only partial destructive interference occurs between the radiation emanating from opposite sides of the structure. Grey solitons have the special property that they propagate at an angle relative to the background beam [2]. This is because the non-zero on-axis intensity can only be created if some travelling wave crosses the soliton. The travelling wave is created by the relative transverse motion between the soliton and the beam. Grey solitons can only exist in (1+1)D geometry.

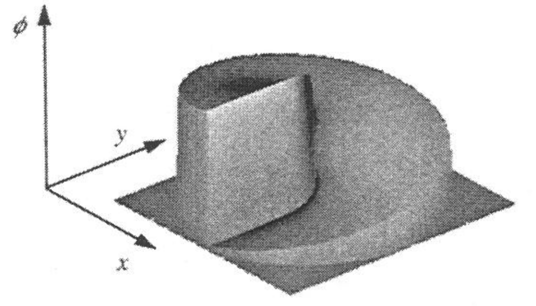

***Figure 1:** An illustration of the phase distribution associated with a singly charged optical vortex (soliton).*

The (2+1) dimensional black soliton is an interesting object. How does one create a structure where the phase on opposite sides differs by exactly π for all directions about that point? The solution is simple [3], the phase of the beam must vary azimuthally by $2m\pi$ (m being an integer known as the "vortex" charge) for one full rotation. The phase of the optical vortex soliton is thus a spiral linking adjacent phase fronts of the quasi-plane background wave (see figure 1). In the case where the total phase changes by exactly 2π, the wavefront is fully connected. Again such a structure can be created in a linearly diffracting beam and is known as an optical vortex using an analogy between the phase gradients in this beam and the velocity profile of a vortex in hydrodynamics. The nonlinearity serves to stabilise the size of the vortex.

4. Solitons and Waveguides

There is an interesting and important analogy between the field of any optical soliton and that of a single mode optical waveguide: in both cases, the field profiles do not change in the direction of propagation. In fact if one examines the refractive index profile induced in the medium by the soliton it is completely analogous to that of a waveguide with a raised index in the centre of the beam relative to the edges. This is, in fact, true for both bright and dark solitons, and hence solitons in general can be thought of as self-guided waves – they induce optical waveguides into the nonlinear medium and propagate as modes of those induced waveguides. Bright solitons are bound modes of the waveguide they induce, whereas dark solitons are the particular radiation mode of the waveguide for which there is no reflection at the boundaries. These analogies are very useful when we consider the use of spatial solitons for photonic switching as will be discussed later.

5. Soliton Collisions

Solitons, when they collide, behave in different ways depending on the nature of the nonlinearity of the medium. For Kerr media, solitons interact like elastic particles and hence there is no energy exchange between them. Nevertheless, a pair of identical bright solitons can attract or repel each other depending on their relative phase [4], or spiral around each other in bound orbits [5]. In saturating nonlinear media, the interaction is no longer elastic: energy exchange can occur and the solitons can fuse or split during a collision.

Until very recently, few of these interaction phenomena had been observed experimentally, particularly in the (2+1) dimensional case. Experimental work at the ANU, motivated by the predictions and interests of our very active theory group within the Optical Sciences Centre, and elsewhere, has now demonstrated many of these processes. In addition, the recognition and demonstration that both photorefractive crystals [6] and second order nonlinear materials [7] can be used to create spatial solitons has given the field considerable momentum in the past few years. Some of the recent results from the work on photorefractive spatial solitons are remarkable – especially since these experiments can be performed using only microwatts of laser power thanks to the strength of the nonlinear response of these materials. In fact very recently solitons were generated using a white light source rather than a laser [8]. The downside to the use of photorefractive materials, is, however, their

tediously slow response speed, and in many cases the solitons form only after several minutes of exposure.

6. Some Experimental Results

Some of the phenomena which have been observed recently at the ANU are presented in a series of images (figures 2-5).

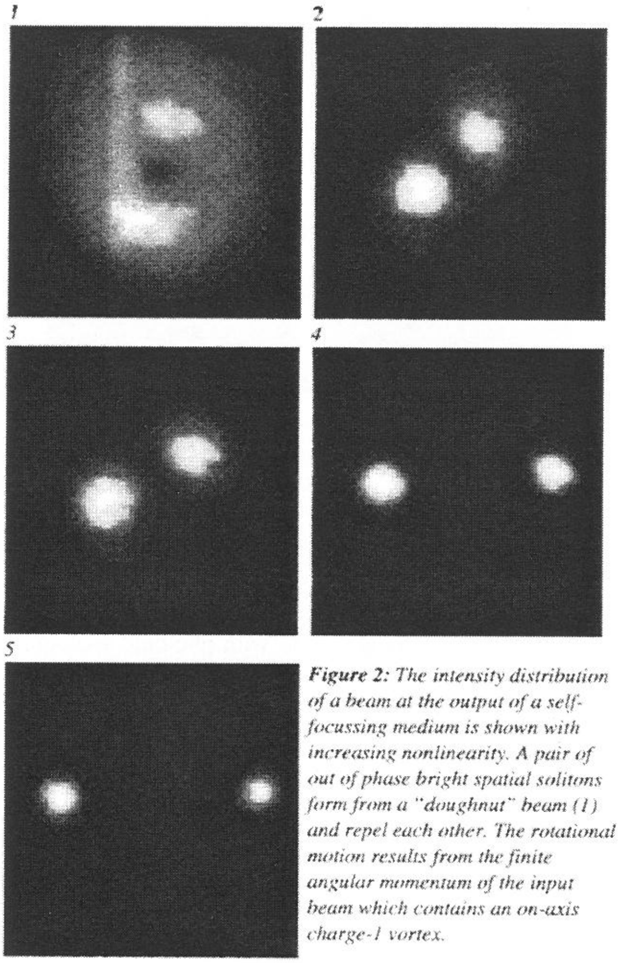

Figure 2: *The intensity distribution of a beam at the output of a self-focussing medium is shown with increasing nonlinearity. A pair of out of phase bright spatial solitons form from a "doughnut" beam (1) and repel each other. The rotational motion results from the finite angular momentum of the input beam which contains an on-axis charge-1 vortex.*

Figure 2 shows data from an experiment in which a pair of two dimensional spatial solitons form from a "doughnut" mode beam. In this case the nonlinear medium was rubidium vapour pumped near 795 nm using a Ti:sapphire laser tuned to the high frequency side of the resonance line. The solitons were created out of phase and hence they repel and twist around each other as they propagate [9]. In figure 3 the solitons are in phase and the basic force between them is attractive. Rubidium vapour has a saturable nonlinearity and so these solitons attract and fuse forming a central core with two remnants spiralling away from each other [10]. The failure of the solitons in this experiment to completely fuse warrants some comment. As is evident in both figures 2 and 3, a slightly elliptical "doughnut" beam is used as the excitation source. In fact this beam is rather special and the on-axis zero of intensity exists because in both cases and optical vortex is located at that point creating a field zero for reasons described above. Thus both beams have spiral phase distributions: in figure 2 the total azimuthal phase change being 2π, and in figure 3 it is 4π. These types of beam were chosen so that as the solitons formed from opposite sides of the beam (seeded by the ellipticity of the input beam) they would have a very well defined phase. However, beams containing optical vortices have finite *angular* momentum: and this angular momentum must be conserved during propagation. Our numerical results show that the central spot formed by fusion of the in-phase solitons has zero angular momentum and hence to satisfy the conservation law the out pair of solitons must exist and complete fusion is impossible.

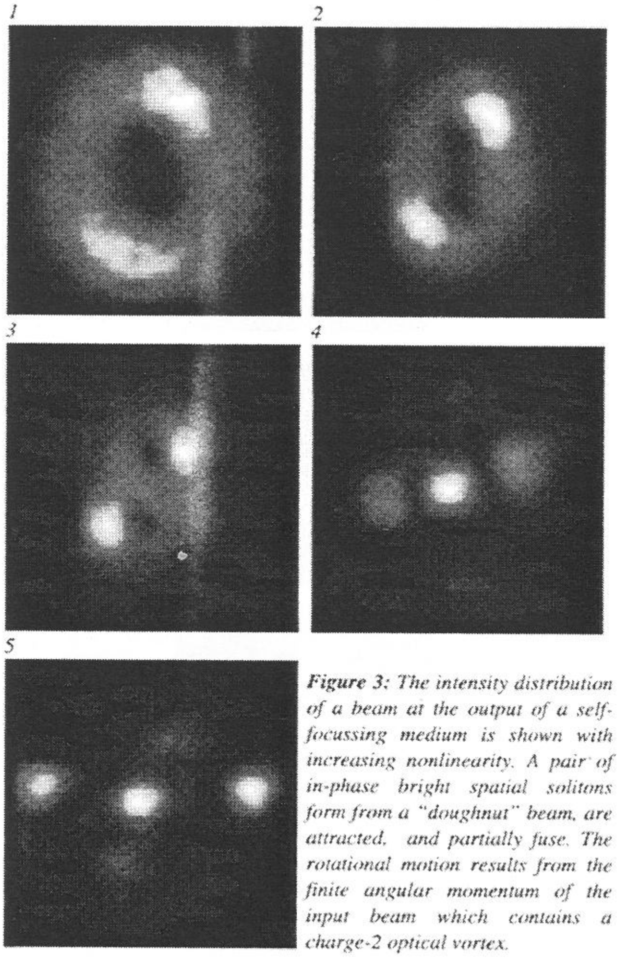

Figure 3: *The intensity distribution of a beam at the output of a self-focussing medium is shown with increasing nonlinearity. A pair of in-phase bright spatial solitons form from a "doughnut" beam, are attracted, and partially fuse. The rotational motion results from the finite angular momentum of the input beam which contains a charge-2 optical vortex.*

Another example of a recently observed phenomenon is shown in figure 4. It shows the break-up of a dark soliton stripe into a pair of optical vortex solitons [11]. A dark soliton stripe is a quasi-(1+1)D structure formed by imposing a π phase shift across the centre of a laser beam. In a defocusing nonlinear medium (in this case Rubidium vapour pumped by a Ti:sapphire laser) a dark soliton stripe forms (4a). Theoretical and numerical work predicted that such a stripe should be unstable to a snake-like instability [12]. This has now been observed experimentally. The bending (4c) eventually leads to creation of pairs of optical vortex solitons (dark spots in figure 4e and f).

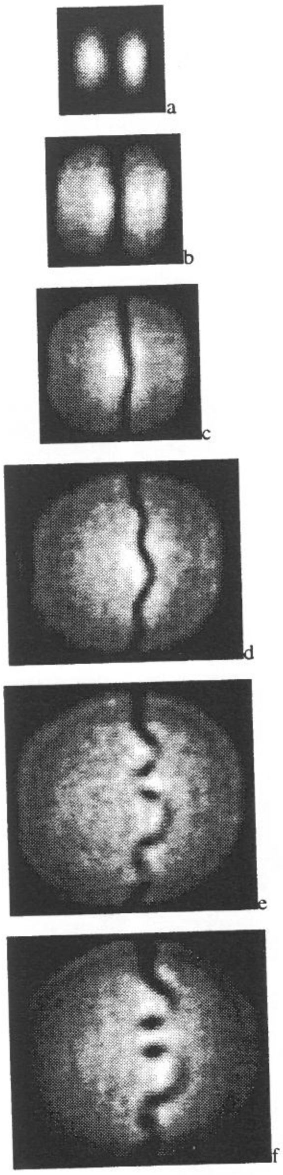

***Figure 4:** Output profiles of a beam containing a πphase jump across its centre after passing through a defocusing nonlinear medium. With increasing nonlinearity the input dark stripe (a) collapses to form a dark soliton stripe (b,c), which then develops a snake-like instability (c,d), before breaking to from a pair of oppositely charged optical vortex solitons (f).*

Figure 5 shows the creation of a single optical vortex soliton from a beam containing a singly charged optical vortex. The vortex field in this case was created at the centre of a Gaussian laser beam using a diffracting mask. As the nonlinearity increases (controlled by changing the laser detuning relative to the absorption resonance) the background beam defocuses and the dark hole narrows forming the dark spatial soliton.

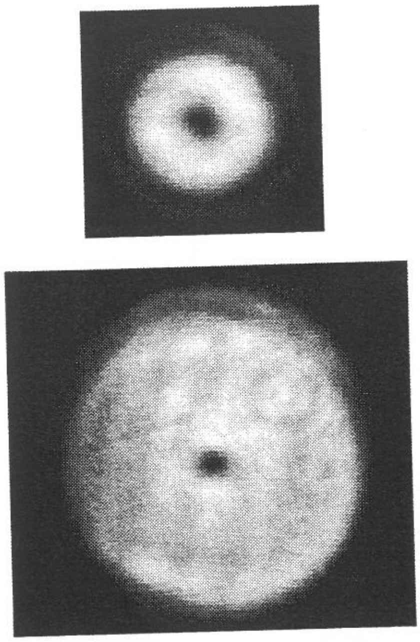

***Figure 5:** Beam profiles at the input and output of a defocusing nonlinear medium showing the creation of a optical vortex soliton from a "doughnut" mode beam. Note, the defocusing of the background beam which accompanies narrowing of the vortex core as the soliton forms.*

7. Photonic Switching

So what has all this got to do with photonic switching? The waveguide analogy is important here: solitons induce waveguides into nonlinear optical media, so wherever a spatial soliton exists in the medium so does an induced waveguide. One possibility is to use these waveguides to propagate signal-carrying beams. By controlling the trajectory of the soliton a series of optically-written, reconfigurable waveguides can be formed to route a signal-carrying beam through the nonlinear medium. As a result one can envisage soliton induced waveguides as "wires" used to arbitrarily connect a number of input ports to a number of output ports in some switching device.

Controlling soliton trajectories is thus of considerable interest for photonics applications. One of the simplest configurations uses (1+1)D dark spatial solitons. As noted above, the phase change across the "soliton" affects the direction of propagation relative to the background beam. By simply adjusting that phase the soliton can then be steered in a relatively arbitrary direction [13]. A computer simulation where three dark solitons with different phase are launched into a defocusing medium is shown in figure 6. Also shown are the trajectories of the beams guided in the soliton induced waveguides. Note that this simulation shows what happens when the solitons collide. For this simulation, which represents a Kerr nonlinearity, the signal beams pass unaffected through the crossing zones.

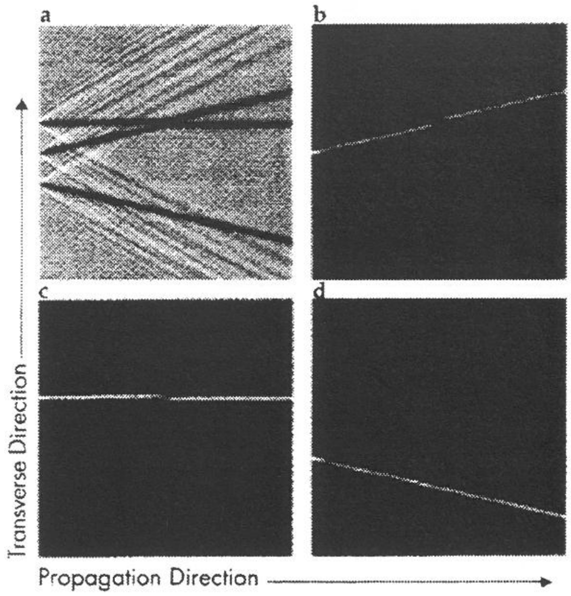

Figure 6: A grey scale representation of the top view of light fields propagating in a planar defocusing nonlinear waveguide in which three (1+1)D dark spatial solitons are excited. Top Left: the soliton intensity distribution with the two grey solitons crossing a single black soliton. Right top and bottom row: the intensity distribution of guided waves launched into the soliton induced waveguides. Note the guided beams cross the soliton-induced junctions without loss.

Another example of soliton steering is shown in figure 7. In this case an optical vortex soliton is moved around a background beam by a weak coherent background wave [14]. The phase of this additional wave can be adjusted to control the position of the soliton at the output.

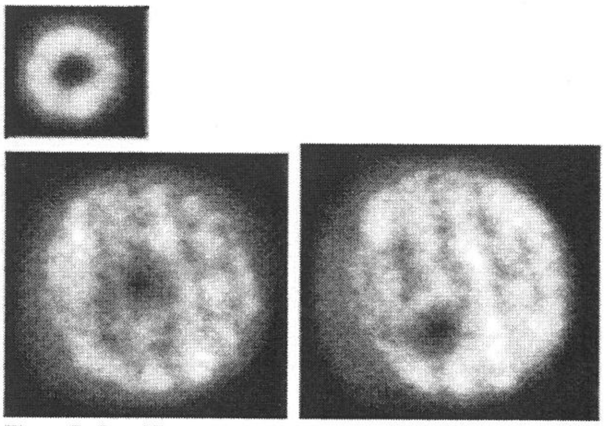

Figure 7: By adding a weak coherent background wave the position of an optical vortex soliton within a beam can be moved radially and azimuthally (depending on the background beam phase). Upper left: input beam; lower left: output beam with no background; right: output beam with background present.

Several other examples of soliton induced waveguides which are useful in photonics have been suggested [15]. Ideal adiabatic tapers can be formed as a soliton evolves from the input field containing an odd phase jump. A waveguide y-junction is created during the formation of a pair of (1+1)D dark solitons from a amplitude perturbation in the input beam. Dark (and recently bright) solitons have been demonstrated to spiral around each other – the degree of twist controlled by the nonlinearity. All these processes may be useful for optical switching in the future.

8. Challenges

Whilst these "proof of concept" results have been interesting, challenges exist in the development of suitable nonlinear materials to achieve ultra-fast switching in waveguide devices. While such materials remain in the development phase, scientists have been looking for other ways that spatial optical solitons might be useful. Recently it has been suggested that some of the most interesting optical properties observed for these nonlinear structures may be useful in designing ideal *linear* devices [16]. This possibility will be investigated experimentally using a newly developed UV direct writing facility at the ANU.

Acknowledgments

I would like to thank my colleagues Vladimir Tikhonenko, Jason Christou, Yuri Kivshar, Xiaoping Yang, Rebecca Powles and Allan Snyder for their many contributions to this research.

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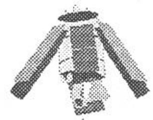

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Frequency Fluctuations in Lasers

Esa Jaatinen
CSIRO National Measurement Laboratory
PO Box 218, Lindfield, NSW 2070

Lasers produce light over a narrow spectral range. However, for many applications this spectrum is still too broad. If this is the case, active stabilisation can be used to reduce frequency fluctuations and produce narrower line widths.

1. Introduction

Since its first demonstration in the early 1960's, the laser has become an irreplaceable tool in the research laboratory, industry, and every-day life. Lasers are used to cut material, measure quantities, hold atoms, and even play our music. New applications are constantly emerging because of the rapid rate at which laser technology is improving, resulting in light sources with more power, greater coherence, and a greater range of wavelengths. Each application relies on one or more of the laser's superior properties (frequency stability, coherence, power or spatial field distribution) to achieve its goal. For example, if high intensities are desired, the power and the spatial mode structure are important, while in spectroscopic measurements, the frequency and its stability must be well behaved.

Many regard a laser to be a monochromatic source because it emits light over a much narrower range of the spectrum than other sources. In practice, however, the spectral width of the laser emission may still be too broad to be used in a particular situation. For example, it would be very difficult to perform saturated absorption spectroscopy on iodine with an argon ion laser running on all of its lines. In this case the spectral width of the light is more than one million times too broad for the task. Even if the laser is restricted to lasing on one line, the spectral width is still more than one hundred times to wide. So for some applications, using a laser with the wrong spectral characteristics is no better than a white light source. Therefore, it is useful to have an idea of the spectral width of the laser emission and how the centre frequency varies with time. These two quantities define the frequency stability of the laser and this article looks at what perturbs a laser's frequency, and ways to reduce these influences.

2. Spectral Content of Laser Emission

In its simplest form a laser consists of a linear cavity formed by two mirrors which are separated by a light amplifying medium (see figure 1). The cavity is often refered to as the 'resonator', and the medium as the 'gain medium'.

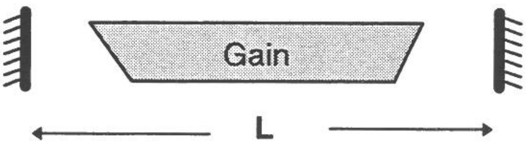

Figure 1 : *Schematic of a laser, consisting of a cavity formed by two mirrors which are separated by a light amplifying medium. One of the mirrors is only partially reflecting so that light can escape.*

Since the gain medium provides the optical energy used in the lasing process, its properties determine the range of frequencies that the laser frequency must come from. For any laser this range is described by a continuous envelope that is centred on the laser transition, but has a width much broader than that expected from the natural lifetimes for the transition [1].

Visible gas lasers (eg He-Ne, Argon ion) and dye lasers have gain envelopes that have widths determined by the motion and interaction of the atoms, ions or molecules of the gain medium. In solid state lasers (eg Nd:YAG, Ti:Sapp) it is the stain and stresses on the solid gain medium that lead to broadening of the transition. As an approximate guide, a gas laser like a He-Ne has a gain envelope of the order of hundreds of MHz wide, a Nd:YAG solid state laser will be many tens of GHz wide, while dye lasers can have gain envelopes that are tens of THz wide.

While the gain medium provides the light and determines the frequency range, the actual frequency of the laser emission depends on the resonator in which the gain medium is contained. The mirror spacing of the resonator selects the possible 'modes' within the gain envelope in which light can be emitted (see figure 2). If a small enough cavity length is chosen, such that only one longitudinal mode falls under the gain envelope, then the laser will have a single-mode output. In general, though, a laser cavity spacing will be large enough to allow many modes to fit under the envelope, and therefore the laser's output can consist of more than one mode.

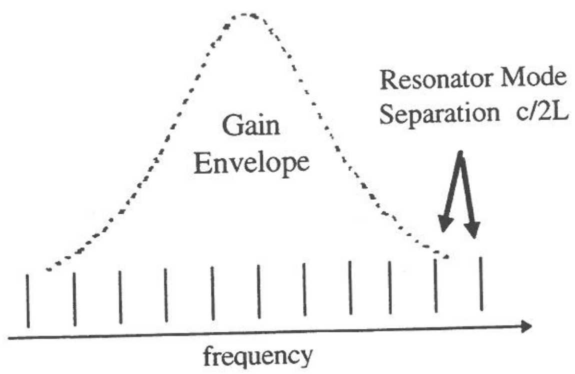

Figure 2: The range of frequencies that a laser can emit light over is determined by the properties of the gain medium, while the actual frequency depends on the properties of the resonator.

Unwanted modes may be a problem for applications requiring a monochromatic source. To remove these modes, filtering is sometimes used. Filtering can be done either inside or outside the laser cavity with a Fabry-Perot resonator matched to the frequency of one mode. In lasers like the sealed He-Ne laser, to be discussed later, single-mode output can be obtained by filtering with a polariser outside the laser.

The width of a single longitudinal mode depends on the spectral properties of the resonator (ie mirror reflectivity and cavity losses) and fundamental properties of the laser transition. Widths less than 10 kHz are not uncommon in some lasers. This implies that a single-mode laser should have a frequency that does not vary from its centre frequency by more than 10 kHz, or in other words, it has a frequency stability of 1 part in 10^{10}. However, in practice a free running laser has a stability that is many orders of magnitude poorer. This degradation occurs because of environmental effects that perturb the frequency.

Any variation in the mirror separation changes the laser's frequency. For example, a change in mirror separation of 10 nm in a 1 m visible laser cavity causes a frequency change of the order of 1 MHz. Vibrations and thermal expansion cause changes in the cavity length that can be much greater than 10 nm, and consequently the laser's frequency wanders throughout the entire gain curve over a period of time. Therefore, instead of emitting light in a narrow frequency band of 10 kHz, the laser radiation has a much broader spread of frequencies (ie reduced stability). In a gas laser such as a He-Ne, this results in long term frequency stabilities of 1 part in 10^6 (frequency variations of hundreds of MHz).

The nature of the dominant perturbation determines the time scale over which the laser's frequency stability is affected. Water cooling in argon-ion lasers causes low frequency vibrations in the hertz to kilohertz range that reduce the frequency stability of the laser over periods ranging from milliseconds to seconds. The sealed He-Ne laser on the other hand is essentially vibration free but suffers at the hands of thermal expansion. Therefore, while its stability is good for short times (ie less than 1 second), over a period of hours it may have drifted by more than 100 MHz from its turn-on frequency.

As vibrations and thermal changes are the primary causes of frequency fluctuations, the first step to improve stability is to reduce these effects by placing the laser in a controlled environment. This may also involve modifying the mechanical structure of the laser itself (such as mirror mounts) to reduce its sensitivity to a particular vibration source. Changes of this nature are sometimes referred to as passive stabilisation since the stability is improved by reducing the perturbations. For further improvements in stability the effects of the perturbations themselves must be corrected by active stabilisation.

3. Active Frequency Stabilisation

Frequency stability can be improved by adjusting the laser cavity mirror spacing to cancel the change caused by a perturbation. One way of controlling the cavity length is by mounting one of the mirrors on a piezo-electric transducer (PZT). A PZT responds fast enough to counter most vibrations and thermal changes that the laser experiences. In addition to a mechanism for controlling the cavity length, it is necessary to know how far to move the mirror and in which direction to correct a particular frequency change. Hence, the frequency of the laser must be monitored.

A change in the laser's frequency can be observed by measuring the transmission of light through either a resonator or a resonant group of absorbers. In both of these, the amount of light that is transmitted changes as the frequency of the light varies. Therefore, a photodetector used to monitor the transmission will provide a current that is dependent on the frequency of the light. This current can then be suitably amplified and used to drive the PZT. In this way a perturbation in cavity length alters the current at the detector, causing the PZT to move the mirror to a position which restores the current (and therefore the laser frequency) to the value it had before the perturbation occurred. A typical frequency stabilisation system will then look something like figure 3.

Examples of frequency references that are used to monitor the laser frequency are Fabry-Perot resonators and the resonances of atomic or molecular gaseous species. In both of these the level of light that is transmitted through the reference is sensitive to the frequency of the light, and this sensitivity determines the overall stability of the laser. The frequency response of a Fabry-Perot reference is limited by the quality factor of the resonator. Fabry-Perots that are commercially available make it possible to stabilise the laser frequency to better than one Hz (< 1 part in 10^{14}).

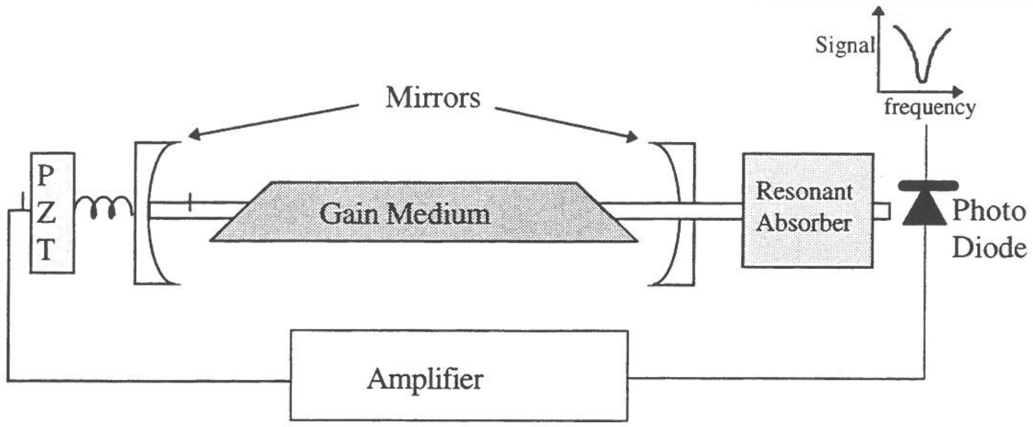

Figure 3: *A typical arrangement of the fundamental components used to frequency stabilise a laser. A resonant absorber is used as a frequency reference to which the laser frequency can be locked. The locking is done by changing the length of the cavity with a PZT in an active feedback loop.*

Optical absorption frequency references, on the other hand, are not quite as sensitive at present, producing stabilities down to the tens of hertz level [2]. However an advantage of using absorption references is that they make it possible to determine the frequency at which the laser is locked very accurately.

Spectroscopists and metrologists have calculated and measured the centre frequencies of literally tens of thousands of absorption transitions to many decimal places. Therefore, the frequency of the laser is obtained by locking the laser to one of these well known transitions. With this technique it is possible to determine the frequency of a laser to approximately one kHz, or about eleven decimal places. In areas like length metrology, such accurate knowledge of a laser's frequency is essential because the uncertainty in the light source frequency translates into an uncertainty in the length measurement.

4. An Inexpensive Tunable Frequency Stabilised Laser

In some applications, light that is stable but also tunable is desirable. For example, to observe the saturated absorption features of a particular gas the laser's frequency must be variable over the range of interest, but it must also remain relatively stable over the duration of the scan. One method of producing a stable, tunable source at the He-Ne laser wavelengths (633 nm, 612 nm, 594 nm and 543 nm) is the two mode power balance technique [3]. This technique can stabilise a He-Ne laser to better than 10 MHz (1 part in 10^8) in the long term, which is also tunable over several hundred Mhz.

An essential ingredient of the technique is a He-Ne laser that emits light in only two longitudinal modes which can be separated. There exists a variety of He-Ne laser which has the end mirrors glued to the laser tube itself which is suitable for this purpose. These hard-sealed tubes are available from several commercial suppliers at relatively low cost (633 nm tubes ~ AU$200 other colours ~ AU$1000). Due to gain competition effects the polarisations of the two modes are orthogonal and easily separated with a polarising element, such as a polarising beam splitter or a Wollaston prism. The powers contained in each of these two modes are monitored by two separate photodiodes. As the two modes drift through the gain envelope due to thermal changes in the tube length, the output from one diode will increase while the other decreases. Therefore, if the difference of the two diode currents is taken (simply by putting them in parallel but reversed with respect to one another) a zero output condition occurs when the two modes are equidistant from the centre of the gain envelope (figure 4).

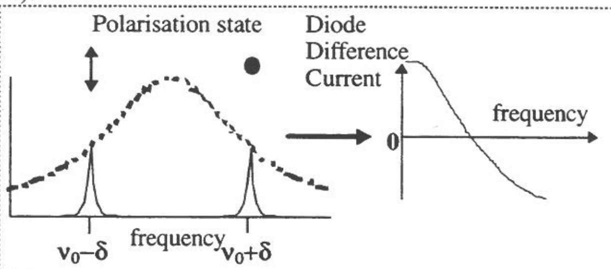

Figure 4 : *When each of the orthogonally polarized modes is equidistant from the centre of the gain curve the diode difference current is zero. Away from this condition the difference current is either positive or negative depending on which is the more powerful mode.*

Away from this equal power position the difference will be either positive or negative depending on which mode contains more power. This difference signal can then be used as an error signal to correct the mirror separation to maintain the equal power condition. In this case it is difficult to use a PZT to correct the cavity length because both mirrors are fixed to the tube. An alternative approach is to wrap a heater around the tube and drive it with the error signal. In this way the cavity length is corrected by causing the laser tube to expand or contract as required. Figure 5 shows a possible arrangement that can be used to stabilise the He-Ne laser in this manner.

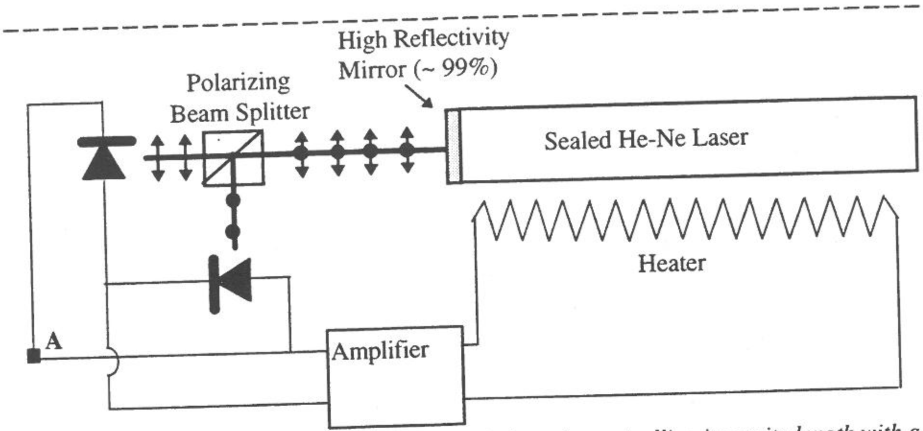

***Figure 5:** Arrangement used to stabilise a sealed He-Ne laser by controlling its cavity length with a heater.*

With this technique the long term stability of the laser improves from 1 part in 10^6 (100s MHz) when it is free running, to approximately 1 part in 10^8 (MHz) under stabilisation. Figure 6 shows a typical example of the improvement in frequency stability that this technique can produce.

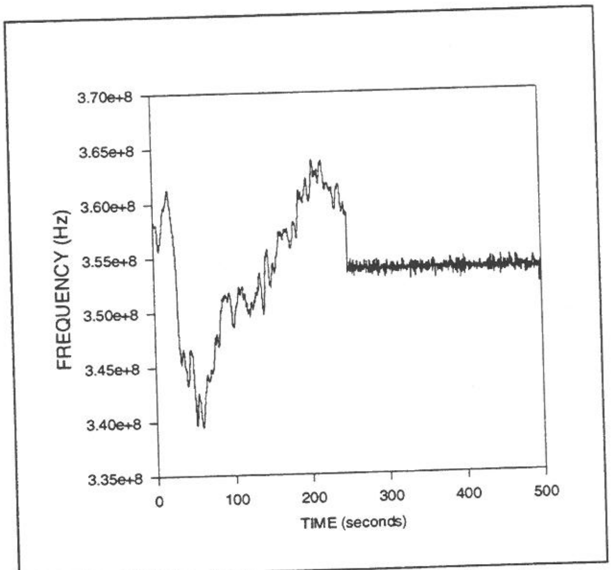

***Figure 6 :** The effect of stabilisation on the laser frequency. For the first 250 seconds the laser is free running. At 250 seconds the laser stabilisation is switched on.*

A further modification that can be made is to offset the photodiode difference current (at point 'A' in figure 5). As a result the difference current is then the difference in optical power of the two modes plus the offset current. Therefore, as the stabilisation servo locks the laser at the frequency at which the difference current is zero, the laser will be locked to a different frequency to that previously. Now the laser can be tuned simply by varying this offset current.

Within the length metrology group at the National Measurement Laboratory (NML), there are several lasers stabilised by the two mode power balance technique that are used for routine work. A green He-Ne laser stabilised in this fashion was used to obtain the scan in figure 7 of the Doppler-free absorption lines of iodine. The scan covers a range of 250 MHz and took less than 30 seconds to perform.

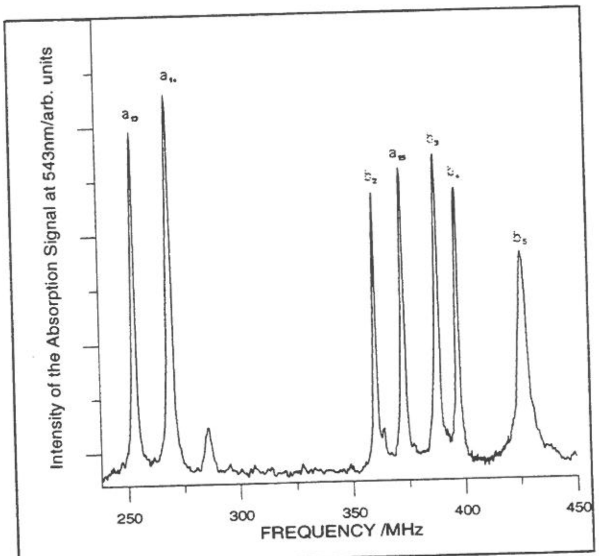

***Figure 7 :** A portion of iodine spectrum at 543 nm observed with a laser stabilised and tuned under the thermal two mode power balance technique.*

5. Conclusion

In many applications a free running laser cannot be regarded as a monochromatic source because of the changes in its frequency that result from environmental perturbations. Frequency stabilisation involves monitoring the laser's frequency and correcting any frequency perturbations by altering the cavity length of the laser. A simple and inexpensive technique for frequency stabilisation was given which can be used to provide a tunable light source.

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[2] J. L. Hall, J. Ye, L.-S. Ma, S. Swartz, P. Jungner and S. Waltman, Proceedings of the Fifth Symposium on Frequency Standards and Metrology, (Ed. J. Bergquist, Singapore: World Scientific, 1996), p267-276

[3] P. E. Ciddor and R. M. Duffy, *J. Phys. E* **16**, p1223-1227 (1983)

Submission Guidelines

The *AOS News* is always looking for contributions from its members. Here's a short summary of the how to make a submission.

What can you submit?

* ***Scientific Article***
A scientific paper in any area of optics.

* ***Review Article***
Simply give a run down of the work conducted at your laboratory, or some aspect of this work. Authors of scientific or review articles will receive proofs by fax.

* ***Conference Report***
If you have been to conference recently, writing a short report would be greatly appreciated.

* ***News Item***
Any newsworthy stories in optics from Australia or abroad.

* ***Book Review***
If you have read an interesting (and relatively new) book in some field of optics please consider a review for the *AOS News*.

* ***Cartoon or drawing***
If you have some artistic bent why not consider submitting a cartoon!

How can you submit?

The easiest way is by email. Either send the document text in your mail, or attach a word processor file using Eudora or your favorite mail program. We accept nearly all file formats. (Famous last words!).

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New Books : The Eye and Visual Optical Instruments

G. Smith and D.A. Atchison
Cambridge University Press, 1997
Paperback ISBN: 0521478200
Hardback ISBN: 0521472520

This new book by George Smith (University of Melbourne) and David Atchison (Queensland University of Technology) has just been published by Cambridge University Press.

The emphasis of the book is on visual optical instruments. It includes conventional instruments such as as simple magnifiers, microscopes and telescopes, and even old and now rarely used instruments such as the sextant. It also includes much more recent instruments such as interferometers used to project interference fringes into the eye and diffractive devices such as laser speckle optometers. Much of the book is dedicated to basic optics, such as paraxial theory, image formation, diffraction, aberration and image quality theory, without which it would be impossible to properly describe the operation of these instruments. The book also includes two chapters on visual ergonomics, which is the interaction and interfacing of the eye with the instruments.

This book was written with a number of professions in mind, for example ophthalmologists, optometrists, vision scientists, optical engineers and anyone who uses visual optical instruments on a regular basis, such as microscopists and metrologists.

Further details and ordering information is on the web at www.cup.cam.ac.uk or www.cup.org.

Book Review: The Eye and Visual Optical Instruments

This is a very useful textbook. It should be part of the working library of every person who is interested in the design or use of optical instruments which interact with the human eye.

The book of 816 pages has 37 chapters and 5 appendices. Most of the chapters have four or five computational exercises included, to allow the reader to check the accuracy of calculation of similar problems. The book is divided into six parts. Part I covers basic optical theory including image formation. There is little in this part which is original, although there are interesting discussions on aspheric surfaces and on the effect of the relativity of the observer when considering image orientation. Part II discusses a range of optical instruments, solely from the viewpoint of geometrical optics. Of particular interest is the chapter on macroscopes, or telescopes used at near a near working distance. This application of telescopes is very common in practice, but theoretical issues such as magnification are rarely treated in optics texts.

Part III covers the theory of diffraction and diffractive instruments such as interferometers. This is the briefest section of the book (48 pages), and suffers from superficiality when compared with many other optics texts. On the other hand, it is also probably of importance to only a small proportion of optical instrument designers and users. Part IV includes the optics of ophthalmic instruments. Given the expertise of the authors, it would be useful if this section was expanded in future editions. Other texts discuss the optics of ophthalmic instruments, but it is rare to find information on the visual aspects of designing and using these instruments. The section does not include some of the most common ophthalmic instruments such as slit lamps and fundus cameras, and an analysis of the visual issues facing a surgeon during, for example, the use of a surgical microscope or the common surgical procedure of posterior capsulotomy using a Yag laser would be of interest.

Part V includes the normal theory of Seidel aberrations. The chapter on the aberrations of the eye and retinal image quality is particularly strong and has an extensive bibliography, reflecting the authors' personal interest in the subject.

The book leads logically to the final part on the visual ergonomics of optical systems. This includes instrument accommodation and vergence, field of view and depth of field considerations, pupil calculations, aberration tolerances imposed by the visual system, and issues of photometry and stereopsis. Much of the information is original although some has been collected from fragments scattered throughout other sources; it is worth buying the book for this part alone.

The book brings together information from a wide variety of sources in physical, geometrical and instrument optics, as well as ophthalmic and visual optics, to provide a unique approach to some commonly encountered issues and also to provide a discussion of many aspects of visual optics which are not included in other books.

The book has been well proof read. In twenty pages, selected at random, I did not find a single error of spelling or mathematics, although the grammar was a little awkward at times. This is a notable achievement in a first edition.

I recommend this book without reservation.

Rod Watkins
Scan Optics Pty Ltd.

Book Review :
The Craft of Scientific Writing

Michael Alley
Springer-Verlag New York, Inc
3rd Edition, 1996
ISBN : 0-387-94766-3 (softcover)

Scientific writing is a difficult process for many scientists and engineers. Yet good writing is important so that we can publish our work, make reports, write grant proposals, and communicate with the public. Michael Alley's book is a useful companion to anyone interested in improving his or her writing skills. Through the use of real examples and suggested revisions, good writing is contrasted with bad, and the differences are discussed in a logical manner.

The author approaches scientific writing with the goals of such writing firmly in mind. These goals are to communicate, in the case of most papers and articles, and to argue, more often the case in proposals. In the first instance, all important results should be included in the abstract and introduction, so that the reader can map his or her way through the document. When presenting an argument, however, it may be more appropriate to start with something the audience will agree with, and move towards the final resolutions in small steps.

Although these goals are discussed in the abstract, plenty of examples are given. More importantly, the author's recommendations for achieving these goals are logical, and thus let us see *why* writing is good or bad. For example, Alley argues that writing is easiest to read when it conforms to the reader's expectations. Sentences which do not conform to these expectations 'trip' the reader, and must be read slower. Examples include grammatical errors, pronouns where the subject is not immediately obvious, and lists of incompatible objects. In these cases the reader must slow down and check to find out what's really going on, making for difficult reading.

Another type of 'trip' occurs when punctuation is used incorrectly — especially the comma and period. The comma is used too infrequently in scientific writing, and the period is often used inappropriately. For example, Alley recommends avoiding abbreviations such as "fig.1" because they momentarily trick the reader with the suggestion of a sentence break. Writing with many abbreviations also looks complicated on the page.

Reader expectations are also the reason we need links between sentences, paragraphs, and sections. Without links, the first half of a sentence can be difficult to understand until the whole sentence has been read, which again serves to slow the reader.

Some attention is given to keeping scientific writing simple. This can be achieved by choosing familiar words, and removing unnecessary words and phases. The book pays suitable disrespect to what it calls 'bureaucratic writing' where "...empty nouns such as 'target', 'parameter', and 'development' fill the page without examples to anchor the meaning of those nouns." This type of writing is quickly dealt with. For example (from the appendix "A usage guide"),

> *"-ization nouns :* often pretentious. You should challenge '-ization' nouns and search for simpler substitutes. For example, replace 'utilization' with 'use'. In cases where you have monstrosities like 'prioritization' you should rewrite the entire sentence in forthright English."

Alley stresses the importance of revision. He suggests not only waiting a few days before attempting a revision, but also using a different medium (such as a hardcopy, rather than a computer document), and even a different location.

I found nearly all of the author's suggestions to be logical and useful. My only reservation lies with Alley's use of repetition. He uses repetition to avoid unclear use of pronouns, preferring to repeat the entire phrase. He argues that the few extra words are worth it because of the gain in clarity. Although I agree with his decision to avoid such pronouns, I can't help finding this writing fairly dull when the phrase contains more than two words. In some cases I would prefer to write around the pronoun to avoid ambiguity without requiring repetition. However, Alley's advice concerning the use of repetition for emphasis (as opposed to just being redundant) is spot on.

The book covers different types of documents: scientific articles, proposals, and correspondence. In particular it covers titles, abstracts, plans, and summaries, as well as illustrations. The book is fun to read, the examples are from documents of interesting events (such as the eruption of Mount St. Helens and the Challenger space shuttle disaster), and the text is infused with gentle humour and anecdotes. I recommend it to anyone interested in improving his or her writing.

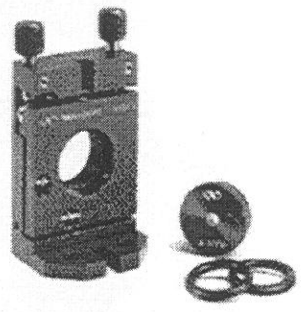
Duncan Butler
CSIRO National Measurement Laboratory
PO Box 218, Lindfield NSW 2070

Read a good book lately ?

Book reviews are welcome submissions to the *AOS News* !

Coherent Scientific

Newport



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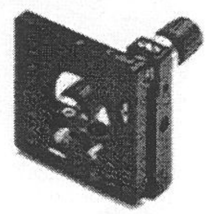

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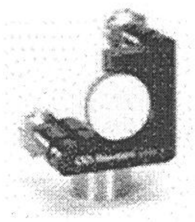

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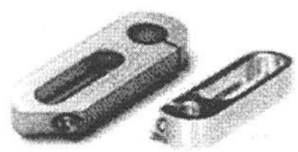

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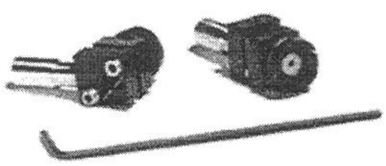

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Meetings Calendar at a Glance

Date	Meeting 1997	Contact	Location
Jun 2-5	Euro American Workshop Optoelectronic Information Processing	EOS	Barcelona, Spain
Jun 4	Pattern Recognition in Practice V	IAPR	Vlieland, Netherlands
Jun 8-12	3RD Med. Workshop On Novel Optical Materials and Apps. (NOMA)	OSA	Cetraro, Italy
Jun 9-13	International Workshop On Adaptive Optics For Industry and Medicine	OSA	Shatura, Russia
Jun 14-19	9th CIMTEC	EOS	Florence, Italy
Jun 15-19	Asme Electronic Packaging Conference&Exhibition (INTERPACK '97)	OSA	Honolulu, Hawaii
Jun 16	Meeting on Optical Interconnections	EOS	Edinburg, United Kingdom
Jun 16-20	Lasers '97 Exhibition and Conference	OSA	Munich, Germany
Jun 16-20	EOS Annual Meeting '97 co-located with Laser Munich 97	EOS	Munich, Germany
Jun 16-20	- European Symposium on Environmental Sensing III	EOS	Munich, Germany
Jun 16-20	- Europea Symp. on Lasers and Optics for research and Manufacturing	EOS	Munich, Germany
Jun 16-20	- European Symposium on Microelectronics Manufacturing I	EOS	Munich, Germany
Jun 17-18	Non-Astronomical Adaptive Optics Topical Meeting	OSA	Munich, Germany
Jun 23-17	ISMA '97 - International Sym. on Microelectronics and Assembly	SPIE	Singapore
Jun 24-25	Advances in Acousto-Optics (15th EOS/TM)	EOS	St Petersburg, Russia
Jun 29-4	Sixth Int. Symposium on Photon Echoes and Coherent Spectroscopy	SPIE	Yoshcar-Ola, Russia
Jul 1-3	Displacement Measurements (14th EOS/TM)	EOS	Nantes, France
Jul 2-4	Applications Of High-Performance Computers In Engineering (HPC 97)	OSA	Santiago, Spain
Jul 7-9	Diffractive Optics (12th EOS/TM)	EOS	Savonlinna, Finland
Jul 7-10	Technologies and Combustion For A Clean Environment	OSA	Lisbon, Portugal
Jul 7-10	Airborne Remote Sensing Conference and Exhibition	OSA	Copenhagen, Denmark
Jul 8-11	Solid-State Lasers: Materials and Applications (SSLMA)	OSA	Tianjin, PRC
Jul 8-12	Materials for Nonlinear Optics (11th EOS/TM)	EOS	Capri, Italy
Jul 9-11	Optical Guided Waves and Applications	AOS	Canberra, Australia
Jul 13-18	Advances in Optical Technologies for Medicine and Surgery	SPIE	Snowbird, Utah
Jul 14-17	CLEO/Pacific Rim	OSA	Chiba, Japan
Jul 21-23	Optical Amplifiers and Their Applications Topical Meeting	OSA	Victoria, Canada
Jul 21-25	Sixth International Symposium on Display Holography	SPIE	Lake Forest, IL
Jul 27-1	SPIE Annual Meeting	SPIE	San Diego, Califomia
Aug 19-22	Education and Training in Optics	ICO	Delft, Netherlands
Aug 26-30	Symposium On Optical Information Science and Technology	OSA	Moscow, Russia
Sep 5-9	Biomedical Optics Europe V	EOS	San Remo, Italy
Sep 6-8	COLOQ'97	EOS	Strasbourg, France
Sep 9-12	5th International Conference on Optics (ROMOPTO'97)	EOS	Bucharest, Romania
Sep 15-17	FRINGE '97 Automatic Processing of Fringe Patterns	SPIE	Bremen, FRG
Sep 17-19	Photomask Technology and Management	SPIE	Santa Clara, Califomia
Sep 21-25	European Symposium on Satellite Remote Sensing IV	EOS	London, United Kingdom
Sep 22-26	Atomic and Molecular Pulsed Lasers II	SPIE	Tomsk, Russia
Sep 22-24	Photonics East and Electronic Imaging International	SPIE	Boston, Massachusetts
Sep 22-25	Integrated Optics and Optical Fiber Communications (IOOC '97)	OSA	Edinburgh, United Kingdom
Sep 22-25	European Conference On Optical Communication (ECOC'97)	OSA	Edinburgh, United Kingdom
Sep 29-30	Micromaching and Microfabrication	SPIE	Austin, Texas
Oct 1-3	Microelectronic Manufacturing	SPIE	Austin, Texas
Oct 6-8	Optical Materials for High Power Lasers	SPIE	Boulder, Colorado
Oct 12-17	OSA'97 Annual Meeting: Focus on the Life Sciences	OSA	Long Beach, Califomia
Oct 12-17	Interdisciplinary Laser Science Conference (ILS-XIII)	OSA	Long Beach, Califomia
Oct 15-17	Applied Imagery Pattern Recognition Workshop	SPIE	Washington, DC
Oct 15-17	Organic Thin Films For Photonics Applications Topical Meeting	OSA	Long Beach, Califomia
Oct 17-18	Lasers In Dermatology: Bio-Optics and Treatment Of Human Skin	OSA	Long Beach, Califomia
Oct 25-31	FALL TOPICAL MEETINGS	OSA	Williamsburg, Virginia
Oct 25-31	- 12th International Conference on Optical Fiber Sensors	OSA	Williamsburg, Virginia
Oct 25-31	- Bragg Gratings, Photosensitivity, and Poling in Glass Waveguides	OSA	Williamsburg, Virginia
Oct 25-31	- Glass and Optical Materials Division (GOMD) Meeting	OSA	Williamsburg, Virginia
Oct 27-31	Joint Magneto-Optical Recording International Symposium (MORIS)	OSA	Yamagata, Japan
Oct 27-31	International Symposium On Optical Memory (ISOM '97)	OSA	Yamagata, Japan
Dec 4-6	DICTA-97 (Digital Image Computing: Techniques and Applications)		Auckland, New Zealand
Dec 4-6	Image and Vision Computing New Zealand		Auckland, New Zealand
Dec 10-12	AOS XI : The Bi-Annual Conference of the Australian Optical Society	AOS	Adelaide, Australia

Meetings Calendar at a Glance

Date	Meeting 1998	Contact	Location
Jan 24-30	**Photonics West**	SPIE	San Jose, California
Feb 21-28	**SPIE's International Symposium on Medical Imaging**	SPIE	San Diego, California
Feb 22-27	**Optical Fiber Communication Conference (OFC '98)**	OSA	San Jose, California
Mar 23-27	**Symposium on Advanced Networks and Imaging Technologies II**	EOS	United Kingdom
Mar 30-3	**Integrated Photonics Research**	OSA	Victoria, Canada
Apr 1-3	**Nonlinear Guided Waves and Their Applications**	OSA	Victoria, Canada
Apr 16-17	**Photomask Japan '98**	SPIE	Kawasaki City, Japan
May 3-8	**Conference On Lasers and Electro-Optics (CLEO '98)**	OSA	San Francisco, California
May 3-8	**International Quantum Electronics Conference (IQEC '98)**	OSA	San Francisco, California
Jun 8-12	**European Symposium on Environmental Sensing IV**	EOS	Lyon, France
July 19-24	**SPIE's 1998 Annual Meeting**	SPIE	San Diego, California
Sep 7-11	**Biomedical Optics Europe VI**	EOS	Scandinavia
Sep 13-18	**CLEO/Europe**	OSA	Glasgow, Scotland
Sep 13-18	**European Quantum Electronics Conference (EQEC '98)**	OSA	Glasgow, Scotland
Sep 21-25	**European Symposium on Satellite Remote Sensing V**	EOS	Taormina, Italy
Oct ?-?	**Photonics Europe'98**	EOS	Paris, France
Oct ?-?	**- Symp. on Optics and optoelectronics for Public Safety III**	EOS	Paris, France
Oct ?-?	**- Symp. on Lasers, Optics and Vision for Productivity in Man. III**	EOS	Paris, France
Oct 4-9	**OSA Annual Meeting**	OSA	Baltimore, Maryland
Oct 4-9	**Interdisciplinary Laser Science Conference (ILS-XIV)**	OSA	Baltimore, Maryland
Oct 11-15	**European Symposium on Optics and Optoelectronics for Public Safety**	EOS	Wiesbaden, Germany
Oct 14-17	**Intelligent Systems and Advanced Manufacturing**	SPIE	Pittsburgh
Nov 2-7	**Voice, Video, and Data Communications**	SPIE	Texas
Date	**Meeting 1999**	**Contact**	**Location**
Feb 21-26	**International Conference On Integrated Optics (IOOC '99)**	OSA	San Diego, California
Feb 21-26	**Optical Fiber Communication Conference (OFC '99)**	OSA	San Diego, California
May 23-28	**Conference On Lasers and Electro-Optics (CLEO '99)**	OSA	Baltimore, Maryland
May 23-28	**Quantum Electronics and Laser Science Conference (QELS '99)**	OSA	Baltimore, Maryland
Sep 26-1	**OSA Annual Meeting**	OSA	Santa Clara, California
Sep 26-1	**Interdisciplinary Laser Science Conference (ILS-XV)**	OSA	Santa Clara, California
Date	**Meeting 2000**	**Contact**	**Location**
Mar 5-10	**Optical Fiber Communication Conference (OFC 2000)**	OSA	Baltimore, Maryland
May 7-12	**Conference On Lasers and Electro-Optics (CLEO 2000)**	OSA	San Francisco, California
May 7-12	**Quantum Electronics and Laser Science Conference (QELS 2000)**	OSA	San Francisco, California
Date	**Meeting 2001**	**Contact**	**Location**
Feb 18-23	**Optical Fiber Communication (OFC 2001)**	OSA	San Francisco, California
May 6-11	**Conference On Lasers and Electro-Optics (CLEO 2001)**	OSA	Baltimore, Maryland
May 6-11	**Quantum Electronics and Laser Science Conference (QELS 2001)**	OSA	Baltimore, Maryland

This list of optics related conferences is compiled from several sources and should be used as a guide only. Further information can be obtained from :

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USA
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Fax: +1 202 416 6100
Email: confserv@osa.org
http://www.osa.org/

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PO Box 10, Bellingham
WA 98227-0010
USA
Tel: +1 360 676 3290
Fax: +1 360 647 1445
Email : spie@mom.spie.org
http://www.spie.org/

EOS (attn. F. Chavel)
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B.P. 147 - 91403 ORSAY cedex - France
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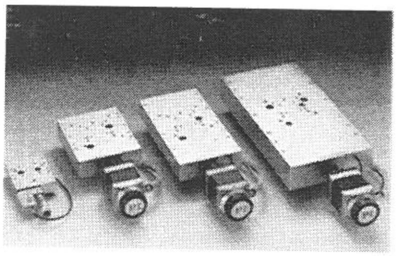
NEWS from WARSASH Pty Ltd

from **PI**: M-100 Linear Stages



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micropositioning,
micromanufacturing

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This 905 nm device in its low-cost form, produces 10 watts peak output power and is ideal for such high-volume applications as range finding.

The 905 is encapsulated in plastic, and high volume production (combined with high quality) means lower costs.

from **RENISHAW**

Renishaw, the manufacturer of 2D imaging Raman microscopes and Raman spectroscopy systems have announced that it has been granted key patents for its technology by the European and U.S. Patent Offices.

They relate to Renishaw's use of a holographic filter at a low angle of incidence as a beamsplitter.

This has the dual purposes of injecting the illuminating laser light into the optical path, and rejecting scattered light of the laser wavelength from the resulting Raman spectrum.

With further patents covering direct 2D imaging using a tunable filter, and for their 'easy confocal' technology, these innovative technologies give Renishaw's customers many unprecedented advantages in terms of high performance, high throughput and ease of use.

from Levy Hill Laboratories

Levy Hill Laboratories have just announced the shipment of their 100th MkVI radiometer/photometer.

It has proved to be:
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- extremely easy to use
- auto-ranging
- with automatic back light &
- ergonomically designed one touch operation.

from labsphere

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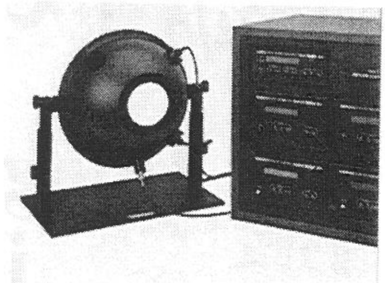
  - calculate/display chromaticity data
  - control light sources & variable attenuators



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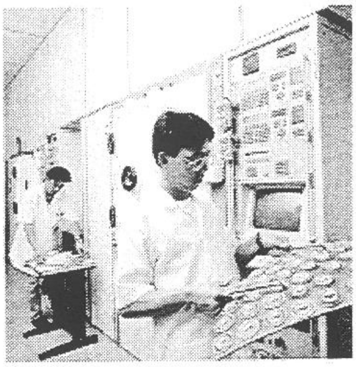
Advanced Thin Films



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- Semiconductors
- Fire optics
- Large optics
- Crystalline material

Consult Avimo's staff to discuss how IAD can benefit your products

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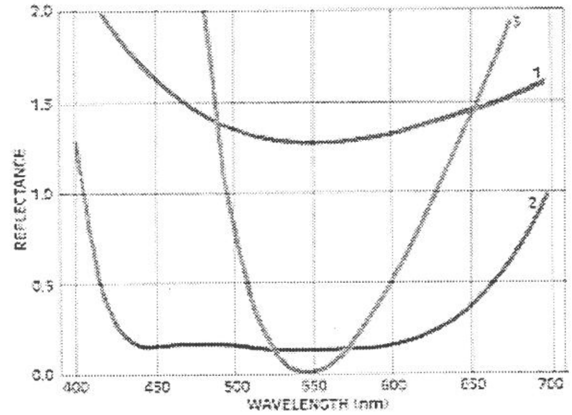

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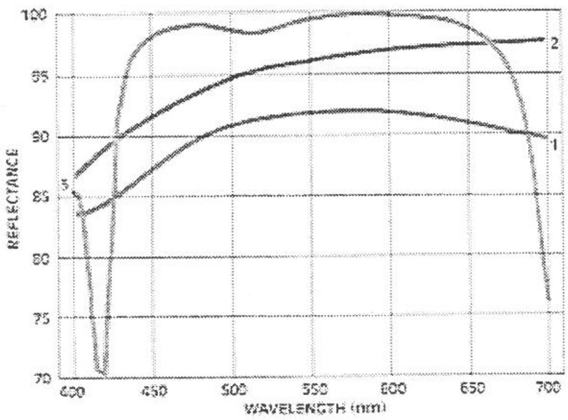

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Avimo metallic coatings are protected to withstand environmental extremes. Second surface reflective coatings are also available.

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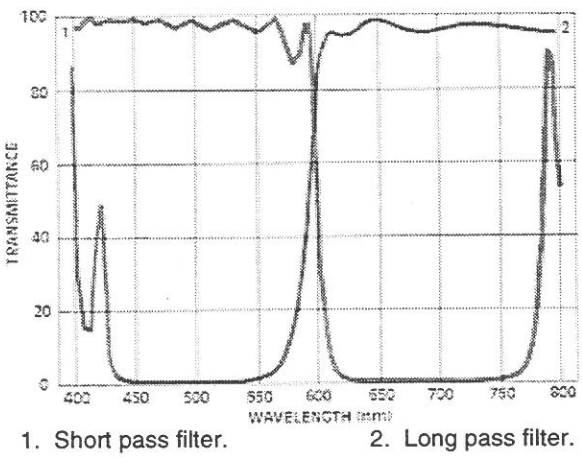

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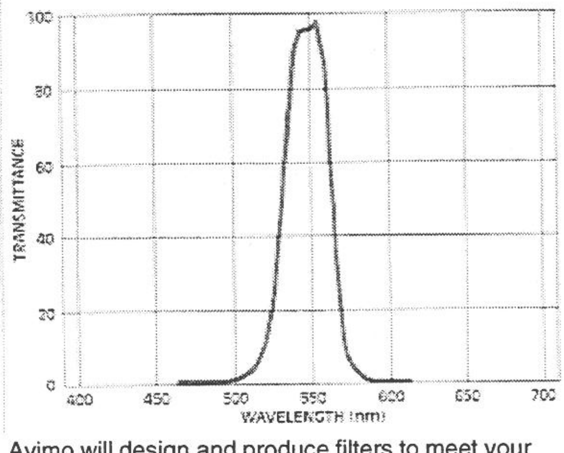

Avimo will design and produce filters to meet your requirements for central wavelength, the full width at half max and blocking properties.

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A Subsidiary of Avimo Group Ltd
14 Fifth Lokyang Road . Singapore 629763
Tel : 2655122 . Fax : 2651479 . E-mail : aeo@pacific.net.sg

AVIMO
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FASTS circular for April.

1. FASTS goes West!
The FASTS submission to the West Review of Higher Education has called on Government and universities to work together to create an efficient, competitive, well-equipped university sector. The increase in the student numbers combined with a decrease in the funding per effective full-time student has put enormous strains on university budgets. Current realities are that not all 37 universities in Australia can offer top-level scientific and technological facilities in education and research in all disciplines.

Reorganisation of the higher education sector is required - and the rearrangements will not be minor. FASTS investigated and considered the consequences of three alternative courses of action in our submission:
a. closing some universities
b. refocussing the universities within a regional area to eliminate course duplications
c. concentrating infrastructure support on the highest-performing departments.

We also urged further support for infrastructure - libraries, labs, buildings and equipment - to accompany the process of reorganisation; and pointed out that it is almost impossible for university graduates to meet industry expectations unless the university equipment they use matches industry standards.

Many university laboratories no longer meet basic occupational health and safety requirements, and are increasingly operating on outdated and failing equipment. I have to thank Dr Chris Easton for his sterling work in drawing the submission together. A full copy is available on our web site.

2. The Budget

(see next page)

3. FASTS in science policy
Minister McGauran has continued to express appreciation for the role FASTS plays in policy formulation. In a recent letter, he said he had instructed his Departmental officers to seek our advice on international scientific collaboration.

He has also invited me to discuss with Chief Scientist John Stocker Victorian initiatives to set priorities for S&T, which were views I initially raised with the Minister.

The role of FASTS in policy areas was the subject of a television interview which Lesley Warner of UCQ recorded with me for the Open Learning Program. It turned out to be a good discussion of FASTS' role in policy, and Member Societies might find it useful to show to their meetings. Copies can be borrowed from the FASTS' office.

4. The WISET Report
WISET made recommendations about boosting the participation of Women in Science, Engineering and Technology (WISET). It was completed in May 1995, and has since disappeared into a black hole. The Labor Government failed to respond in its final months of office (although the Report was commissioned by one of its Ministers).

The new Government has declined to make a formal response to what it sees as a Labor initiative, so even though the Report has been dubbed "a valuable analysis" it still lies dormant. We are urging the Government to take a more active interest in its findings.

Australia suffers because the whole area of SET "expresses a strong sense of masculine ownership" (WISET p3), to the extent that only 6.9% of staff in engineering and processing in higher education institutions are women.

5. Affiliate members
A number of groups have been invited to become non-voting Affiliate Members of FASTS, at the discretion of the Board. They all have an interest in S&T policy and share the broad aims of FASTS but do not fit the narrow definition of a professional or learned society as set out in the FASTS' Constitution.

I believe that the support of these groups will bolster FASTS' capacity to represent the broad interests of S&T groups to Government in Australia. Government prefers to deal with large representative groups which cover the broad sweep of interests of that sector, rather than smaller bodies with strong sectional interests.

6. The Stocker Inquiry
The submission and discussion rounds are almost complete, and the final report is expected about June 22. I expect that among other issues the inquiry will comment on the way in which priorities are set in different portfolios dependant on a S&T information base, and on the advisory processes within and to Government.

7. Senate inquiry into Commonwealth powers in environment
The Senate has initiated an inquiry into Commonwealth powers in environmental protection and ecologically-sustainable development in Australia, to be chaired by SA Democrat Senator Meg Lees.

An information pack on how to make a submission and the terms of reference are available from Committee Secretary Robert King on (06) 277 3525. The closing date for submissions is Friday June 20.

8. John Bell

John Bell, former Deputy Secretary of DIST, has resigned to take up a position as Managing Director of ANUTech at ANU in Canberra from May 19. He has been one of FASTS' strongest allies and supporters, and his resignation places added pressure on the Chief Scientist and his staff in DIST.

9. The newImages Conference

I participated in this Anglo-Australian Conference in Sydney. It compared the roles of the Chief Scientists of the two countries. In the UK the position is supported by 100 staff, but one wonders whether a cost-benefit analysis would show the advisory function there has been any more effective than in Australia.

Likely outcomes include additional exchanges for young scientists, and a cooperative approach to science festivals of each country. But it is clear that the UK has a definite role in the European Union and Australia a growing role in Pacific Rim SET alliances.

10. Media

President-elect Peter Cullen and I had lunch with the Editor and Science Writer of the Canberra Times, to discuss increasing coverage of SET. We were advised to maintain regular contact (not only when we need them!), and make our stories locally relevant.

I still look to every regional newspaper in Australia having regular weekly S&T sections, as the Canberra Times does. Toss Gascoigne is a valuable mentor in this area.

A reminder that the excellent talks at the National Press Club by Ian Lowe and Peter Doherty are available from Media Monitors. Video tapes $40, audio tapes $26, transcripts $50. Ph (06) 239 5233, or fax (06) 239 5244. Both speeches are also on the FASTS' web site (free!)

Joe Baker
7 May 1997

"BUDGET OF DEFERRED OPPORTUNITIES"

(FASTS press release in response to the budget)

The peak body for scientists and technologists in Australia said today (Wednesday) that in framing its Budget the Government had overlooked the immense capacity of science and education to create sustainable employment.

Dr Joe Baker, President of the Federation of Australian Scientific and Technological Societies (FASTS), said that for the first time he could remember, the words "science", "technology" and "education" were not mentioned once in the Treasurer's speech.

"All the most pressing long-term problems facing Australia today have their solutions in science and technology," he said. "But these terms do not seem to be part of the Government's strategy.

"On the positive side, FASTS welcomes modest increases to CSIRO, the National Health and Medical Research Council, Australian Research Council and rural research and development funding," he said.

"The future for these groups is less bright. Forward estimates indicate that there will be cuts to their funding - and to other S&T areas - in subsequent years, continuing a trend of steady and progressive reductions.

"There is no clear policy on developing the smart industries we need to create new job opportunities, and there is no vision for Australia as a nation in the 21st century. The building blocks of the future are being ignored."

Dr Baker said that he had welcomed the extension of a comprehensive long-term plan to develop the pharmaceutical industry (the Factor (f) scheme) when it was announced last month.

"But I am disappointed that the Government has not picked up a suggestion from FASTS that this planned development of one industry should be selectively applied to other industries. It suggests a Government which lacks a clear sense of direction."

He said a detailed analysis of the Budget will have to wait until the Budget Statements for S&T, Environment, Primary Industries and other portfolios are released later this week.

"I am concerned about a $10 million cut over two years to the highly-successful CRC program, and moves to make the Cooperative Research Centres more independent of Commonwealth funding will have important implications for publicly-funded research bodies such as the universities and CSIRO."

Dr Baker said the S&T community was eager for action, and that a lot of the Government's intentions seemed a long way down the track.

Treasurers Comments to the 1997 Audit

Over the last fortnight of April the society had its annual financial examination by the auditor. This is required of us by the Australian Securities Commission, and for the treasurer, it is always a nervous time while the auditor checks your account keeping skills. So it was good to get the big tick from the auditor who found the society financially viable and its books in order. On accompanying pages is the balance sheet of the AOS's finances as prepared by the auditor. However, as they are based on figures for a financial year and not a calendar year, they are a little difficult to interpret. Therefore I will summarise some of the more important figures.

In 1995 the AOS subscription fees were raised to enable the society to pay all its annual expenses. Since that time the society's annual expenditure has matched its income. So it appears that the subscription fees are appropriate. The society obtained approximately $10300 from subscriptions for 1996. There were no significant changes in expenditure or income items from 1995. The largest expenditure item was the *AOS News* which costs approximately $6500 a year to prepare and post.

As of the 1st of May, 1997, the AOS had 247 members financial for 1997. This is approximately 3/4 of the total membership, leaving about 80 still to pay. The membership figures for the past two years are shown in table 1. Over that time the society has enjoyed a growth in membership of approximately 20 new members a year. This level looks likely to continue for 1997 leaving us with 330 members by the end of the year.

Table 1: AOS Membership from 1995 to 1997 (1/5/97)

Type of Member	1995	1996	1997 (1/5/97)	1997 (Pred)
Life	5	5	5	5
Honorary	13	13	13	13
Corporate	13	14	11	15
Regular	219	241	187	250
Student	39	43	31	50
Conference	87	N/A	?	?
Total	**376 (289)**	**316**	**247**	**333**

At the AOS annual general meeting held on the 2nd of May 1997 at Macquarie University, Barry Sanders was elected as the society's new treasurer. I would like to wish him well in his endeavours as treasurer, and if you have any questions regarding the AOS's finances or subscriptions please contact Barry at the following address:

Assoc Prof Barry Sanders
School of MPCE
Macquarie University
North Ryde, NSW, 2109

Tel: 02 9850 8935
Fax: 02 9850 8115
email: barry@mpce.mq.edu.au

AUSTRALIAN OPTICAL SOCIETY
(Incorporated in Tasmania)
A.C.N. 009 548 387

NEWS ACCOUNT
INCOME AND EXPENDITURE
FOR THE PERIOD 1ST JULY 1996 TO 31ST MARCH 1997

1996 $		$	1997 $
	INCOME		
42	Interest Received		9
	Less **EXPENDITURE**		
15	Bank Charges	10	
5761	Newsletter Expenses	3562	
1143	Postages	729	
6919			4301
(6877)	**NET (DEFICIT)/INCOME OVER EXPENDITURE**		(4292)

NEWS ACCOUNT
FUNDS STATEMENT

1996 $		$	1997 $
	CASH AT BANK		
582	Opening Balance - 1st July 1996		117
	Add		
42	Cash Receipts	9	
7500	- Transfer from Commonwealth Bank, Sydney	6500	
7542			6509
8124			6626
	Less		
6919	Cash Payments	4301	
1088	Transfer to Commonwealth Bank, Sydney	-	
8007			4301
117	**CLOSING BALANCE - 31st March 1997**		2325

AUSTRALIAN OPTICAL SOCIETY
(Incorporated in Tasmania)
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SYDNEY GENERAL ACCOUNT
INCOME AND EXPENDITURE STATEMENT
FOR THE PERIOD 1ST JULY 1996 TO 31ST MARCH 1997

1996 $		$	1997 $
	INCOME		
10380	Subscriptions Received	9160	
1134	Interest Received	1762	
11514			10922
	Less		
	EXPENDITURE		
1490	Accountancy, Audit Fees	906	
-	AOS Medals Expenses	12	
227	Bank Charges	236	
292	Filing Fees	32	
503	Meeting of Committee - Travel Expenses	426	
23	Postage	584	
1500	Post Graduate Award	-	
469	Printing and Stationery	174	
1453	Subscriptions	225	
-	Sundry Expenses	241	
5957			2836
5557	**NET SURPLUS/(DEFICIT) INCOME OVER EXPENDITURE**		8086

SYDNEY GENERAL ACCOUNT
FUNDS STATEMENT

	CASH AT BANK		
1562	Opening Balance - 1st July 1996		13245
	Add		
11514	Cash Receipts	10922	
12538	Transfer from - AOS 10th Conference	121	
1088	- AOS News Account	-	
25140			11043
26702			24288
	Less		
5957	Cash Payments	2836	
	Transfer to - Commonwealth Bank, Melbourne		
7500	- AOS News Account	6500	
13457			9336
13245	**CLOSING BALANCE - 31st March 1997**		14952

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14 Fifth Lok Yang Road
Singapore, 2262
Tel: +65 265 5122
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PO Box 180
Salisbury SA 5108
Head Office:
14 Park Way
Technology Park
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Coherent Scientific Pty Ltd
116 Burbridge Road
HILTON, SA, 5033
Tel: (08) 8352 1111
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Tel: (08) 8287 2422
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Kidger Optics Limited
9a High Street
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TN6 2QA
UK
Tel: +44 1892 663555
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QLD, 4215
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PO Box 10269
Gouger St
1st Floor, 123 Wright St
Adelaide SA 5000
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4 electro-optics	11 spectroscopy	18 (.....................................)
5 fabrication and testing	12 thin films	19 (.....................................)
6 information processing	13 vision	20 (.....................................)
7 lasers	14 quantum optics	

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