importance. I remember my discussions with him on the possibility of maintaining self-sustained oscillations through flowing liquids which would perhaps have resulted in an NMR laser; that was not to be because of very poor experimental facilities. During that period Ramachandran was trying to focus X-rays through reflections in poly-crystalline materials like copper. I suggested and made a simple focusing arrangement using a thin sheet of mica and some vacuum. Ramachandran published this in *Physical Review* and he has acknowledged my suggestion which resulted in the work of late Y. T. Thathachari.

I have always marvelled at his paper on collagen and how with hardly a few spots on the X-rays photographs he could arrive at the structure. Had he tackled other bio-molecules, particularly DNA, it would have been a boost for science in India and worthy of Ramachandran's innate genius. However on his return to IISc from Chennai, he founded a very active school on molecular biology which has contributed a lot to that branch of science in India.

I met Ramachandran early last year as an inmate of the voluntary health scheme resort at Chennai. In spite of his physical disability due to an incurable syndrome, he was mentally fully active and I had the occasion to talk to him about some of the work I had been carrying out on time and gravitation and related matters. He was very quick to understand the key points and was immensely happy. I remember him smiling and wishing me all the best.

G. SURYAN

Sunrise Emerging Technologies (R&D),
B-279 (a), 7th Cross,
Peenya Industrial Estate,
Bangalore 560 058, India

Every morning, after breakfast, G. N. Ramachandran and I used to walk to the Physics Department at the Indian Institute of Science, Bangalore. Then he told me that after joining the Electrical Engineering Department at IISc, he used to meet C. V. Raman every evening and talk with him for an hour or two. He also used to request Raman to take him into the Physics Department. I asked Ramachandran, 'Did Raman ask you questions in physics?' Ramachandran said: 'No. He used to tell me that he was writing up his Baroda lectures on optics. (This appeared later as a book entitled *Lectures in Physical Optics*, published by the Indian Academy of Sciences.) He discussed with me, item by item, the various aspects of optics that had interested him (Raman). I never knew that optics could be so exciting. I used to ask him hundreds of questions, to which he invariably gave clear answers. These meetings in the evening were long discussion sessions and after one such long session, late in the evening at about 7 p.m. Raman said, "I think I will try to get you transferred to my Department." My joy knew no bounds. I feel that it was during these conversations and discussions that I really understood the physical basis of Fourier theory and Fourier transform' (This proved to be of great use to Ramachandran for his researches in X-ray crystallography.) Raman sent a copy of the book *Lectures on Physical Optics* to S. Chandrasekhar, to which Chandrasekhar replied: 'I was delighted to receive the other day a copy of your *Lectures on Physical Optics* with your inscription. I had earlier seen this book with Pancharatnam when he visited us last summer. I was most impressed with this book at that time, and I am very happy now to possess a copy. By accident it happens that I am lecturing on advanced optics and I intend to make use of your book in these lectures . . .'

S. RAMASESHAN

Raman Research Institute,
Bangalore 560 080, India

As in Sb clusters

In the article on low energy cluster beam deposition technique by Ravi Prasad *et al.* (*Curr. Sci.*, 2001, **80**, 280–284), although the authors state on p. 282 that 'no other foreign impurities even at ppm level could be detected', the PIXE data (figure 2 *b*) clearly show the presence of arsenic. Two lines are seen as for Sb and from their amplitudes the amount could be a few per cent at least. This is not surprising because the authors state that 'chemically pure Sb was taken'. As belongs to the same group as Sb and is a common impurity in Sb. This is not a trivial observation because the photoluminescence (PL) attributed to Sb cluster is more likely to originate from As, which is a semiconductor with a bandgap of 1.2 eV approx. This would give a PL peak near 1000 nm. The authors state that Sb oxide is present due to the ambient and so, As oxides should also be expected. Combinations of these compounds, all semiconductors unlike Sb which is a semi-metal, if present, could account for the PL near 514 nm.

D. N. BOSE

Advanced Technology Centre,
Indian Institute of Technology,
Kharagpur 721 302, India

Response:

As to the arsenic impurity in the PIXE spectrum, we have used the As doped Si as a substrate for Sb cluster deposition. However, when the PIXE spectra were recorded, the duration of exposure of the bare As–Si to the proton beam was only for 15 min as the thickness of the As–Si wafer is 125 micron. The As peak could not develop for shorter time exposures. After depositing the Sb cluster of 100 Å thickness on the same wafer, we exposed the wafer to the proton beam for 2 h to get good statistics. The PIXE experiments detect the atomic concentration of the sample. As the Sb cluster film is thin enough one may expose the target to the proton beam for long time exposures. In both the cases the proton energies were kept same. Hence, the As detected from the Sb cluster film is solely from the substrate only.

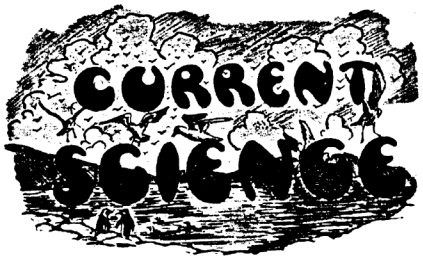
As far as the PL data are concerned the glancing angle XRD of the Sb cluster film detected only Sb and Sb-oxide (Sb_2O_3). Sb_2O_3 is a semiconductor and

has a band gap of 3.0 eV. The oxide is being formed due to atmospheric oxygen (uncapped clusters are prone to oxidation). Such oxides, in general, generate trap states within the band gap of the semiconductor. The intense red-shifted bands around 893 nm and 814 nm are due to trap states only. The low intensity band around 514 nm is the contribution from HOMO–LUMO gap of the Sb cluster. A similar HOMO–LUMO gap has also been detected for nanostructure Sb films around 473 nm (Ludwig, M., Hummel, H. R. E. and Stora, M., *Thin Solid Films*, 1994, **255**, 103). The glancing angle XRD did not detect any As-oxides from our Sb cluster films. Hence, the 514 nm band is not due to As-oxide.

S. N. SAHU

Institute of Physics,
Sachivalaya Marg,
Bhubaneswar 751 005, India

FROM THE ARCHIVES



Vol. IV] JULY 1935 [No. 1

Science and culture

We have pleasure in offering a warm welcome to *Science and Culture*, a new monthly journal of natural and cultural sciences, the first issue of which has reached us by the courtesy of the editor, and whose aim is to promote the cause of science by spreading scientific knowledge among the public. It is further explained that publication is promoted by a non-profit corporation of 'some eminent scientists and educationists of India', whose identity will doubtless be revealed in a subsequent issue.

The subject-matter is varied and interesting. Following an editorial introduction which rapidly sketches outstanding events in the historical development of Indian civilisation, there comes a long and informing article on 'Bengal Rivers and their Training' by Dr N. K. Bose, who wisely advocates establishment of a river physics laboratory resembling those already operating in Western countries, where schemes connected with river-control may be tested before adoption. An article on the 'Ultimate Constituents of Matter' by Professor M. N. Saha deals comprehensively and lucidly with modern views of atomic architecture, and concludes with an imposing list of the fundamental particles involved. Rai Bahadur Ramaprasad Chanda, under the title 'Aryan, Indo-Aryan and Dravidian' traces the various authorities for different forms of *bakti*, while 'Some Reactionary Consequences of Psychoanalysis' are indicated by Col. Owen Berkeley Hill. A short contribution on 'Susruta and Early Hindu Anthropometry', by Dr Panchanan Mitra is followed – abruptly as it may seem to some readers – by 'Safety of Electrical Installations in India' from Professor B. C. Chatterjee.

Other features are book reviews, obituary notices, a full description of the Indian Statistical Institute's foundation and purpose, a report of the U.P. Academy of Sciences April meeting, and letters to the editor. Support is given to the view of Lord Rutherford as expressed in his letter to *The Times* dated 29 April 1935, concerning retention of Professor Kapitza by the Soviet Government, and a useful outline of the distinguished captive's technical ingenuity is presented. Treatment of the subject would have gained piquancy – and perhaps proportion – if Lord Rutherford's contribution had been supplemented by the letter of Professor H. E. Armstrong, who considers that the restoration of Professor Kapitza to his homeland, so far from being a calamity, is merely a blessing in fancy dress; but then it must be remembered that this chemical veteran on a recently previous occasion stoutly opposed himself to the principle of imported professors.

From this brief survey it will be recognised that *Science and Culture* covers a wide range of material, and incidentally it may be stated that the printing and paper are excellent. It remains to consider whether the treatment of the subjects chosen is calculated to achieve the declared purpose of the promoters, namely, 'dissemination of scientific knowledge amongst the public'. A rough classification of the literate public in relation to scientific knowledge would reveal two main groups, namely, specialists in one or more branches, and a generally well-informed public whose members desire to keep themselves aware of such scientific discoveries and principles as may be assimilable without previous training in science. *Nature* and the *Scientific American* are probably the best known journals appealing to these two groups, respectively, and throughout the past three years we have consistently endeavoured to meet the needs of the former group in this country, with strict avoidance of partisan or territorial bias. Some aspects of *Science and Culture* are so similar to the corresponding features of *Current Science* that we confess to misgiving that its promoters have judged us and found us wanting. Actually, there is very little of the material presented in this first issue for which we would not gladly have found space in our columns. The question therefore arises in our mind, is there a large enough public for two similar journals; because, if not, we fear that both must languish, under-nourished in both material and support. On the other hand, there is ample room for a journal popularising science, old and new. Therefore, while welcoming *Science and Culture* we take leave to hope that future issues may devote themselves more definitely to the declared policy of its promoters, and expand on lines complementary to – rather than competitive with – *Current Science.*