

plasma'; ϵ becomes negative for $\omega < \omega_{ep}$, the electron-plasma frequency. He has discussed the circumstances under which one can examine the nature of transmission of light through such materials 'without placing any conditions on μ '. According to Pendry¹⁰, a material with a negative refractive index could make a 'perfect lens'. This is because such a lens would not be restricted by the diffraction limit. A slab of silver (with all dimensions of the order of a few nanometres, that is smaller than wavelength of light) is studied by simulation to see how well one can focus an image using a layer of silver. This concept may be realizable into a practical device.

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Special Issue on Image Processing, Vision and Pattern Recognition

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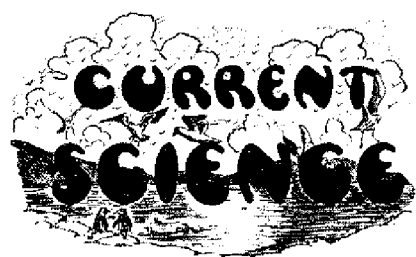
The Indian National Science Academy has published a special issue as cited above in *PINSA (Proc. Indian National Science Academy – Physical Sciences)*. As the Guest editors have stated: 'this special issue reflects a cross section of

the current state-of-the-art in the theory and practice of Image Processing, Vision and Pattern Recognition in solving various real life problems'. There are ten articles in all, beginning with one on Camera Motion and Scene Depth by Cucka *et al.* (A. Rosenfeld considered the father of image processing and computer vision being one of the co-authors). Then follow articles on Detection of people/vehicles in Images, Computer Vision methods for Aircraft Navigation, Aspect Graph based Model-

ling, Colour Image Segmentation, A case study of Fingerprint Domain, Neural Network Algorithms, Pattern Classification (2 articles) and finally on Information Granules, 7 out of the 10 articles are by authors from overseas labs. While 6 of the articles relate to 'classical approaches', 'the remaining articles demonstrate the utility of soft computing tools like artificial networks and rough sets for dealing with various recognition problems'.

RANDOM SELECTION

FROM THE ARCHIVES



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Scientists and war

'There are three lusts which are present in the subconscious mind of man which lie at the basis of war, the lust of *power*, the lust of *prestige*, and the lust of *possession*'. These remarks were made

by Dr Gilbert J. Fowler in the course of his presidential address at a discussion on 'Moral responsibility of scientists in modern warfare', held at Bangalore on 22 August, under the joint auspices of the Society of Biological Chemists, India, and the Institute of Chemistry.

In the course of a thoughtful address, Dr Fowler observed, 'My scientific and professional work has brought me in contact with chemists and engineers all over the world including Moscow and Japan. I may, therefore, claim to be something of a citizen of the world and can have no desire to hate or destroy the many good friends I have made.

My experience will, in some degree no doubt, be that of many other scientists and therefore, the scientist is pre-

eminently fitted to be a friend of all the world.

If, however, this worthy ambition is to be realized, it would seem necessary that certain commonly voiced statements and their implications should first be criticized.

One view which is gaining ground is that the discoveries of scientists are themselves largely the cause of war. The fallacy of this will be evident after a moment's thinking.

It is often apparently assumed that poison gas or chemical warfare is due to the secret and devious investigations of chemists. Actually I believe practically all the gaseous weapons, used in the war, had been discovered previously in the course of purely peaceful investigations.

Another statement constantly made is that war is *inevitable*. This is to mistake the fundamental causation of things. Guns do not attack the enemy automatically, their construction and operation depend obviously on the living mental agent behind them. Therefore it is with this mind that we have to deal. Even if this be granted, however, another frequent statement is that *human nature does not change*. The evil power of mass suggestion is only too evident. In this connection one might refer to another apparent assumption, that men of science are superior to war suggestion. I have not observed that men of science are much less quarrelsome than other people. Personally I have not found that the study of chemistry has in itself enabled me more easily to control my temper or to suffer fools gladly.

Another assumption would seem to be that peace and democracy were desirable things to which all had a right much as we have to air and sunshine. On the contrary they are the rewards of great and persistent effort. Peace is the reward of righteousness. Democracy is the reward of self-discipline.

Actually the root cause of War lies deeper than these material difficulties. I would say that there are three lusts which are present in the subconscious mind of man, which lie at the basis of war, the lust of *power*, the lust of *prestige* and the lust of *possession*.

Let us not, therefore, as men of science make use of any of these half truths in our campaign for the abolition of war. I say for the abolition of *War* because the abolition of any particular weapon is only a part of our task. While it is arguable that there is little to choose between death or torture by poison gas and being smashed by a shell, it must be recognized that throughout the history of humanity certain limits have always been instinctively laid down. This was so even in the old Mosaic law and is implicit in the common expression 'hitting below the belt'. Most people would sooner face a revolver than a bottle of vitriol.

Any joint effort, therefore, which can be made by the scientific workers of the world to limit the use of methods of warfare which involve death and torture to innocent and unprotected people is to be welcomed.

Nevertheless, the intelligence which is capable of investigating the furthest star or the smallest molecule, that has discovered means of communication which have annihilated space and time, can surely produce some result if it will honestly and humbly set itself to the study of these infernal forces which lie in the subconscious mind of man, and which need to be controlled by some higher energy if all the fair prospects of humanity are not to be obliterated in one hideous ruin. The famous psychia-

trist Dr Jung says 'it is the psyche of man which makes wars... the most tremendous danger that man has to face is the power of his ideas. No cosmic power on earth ever destroyed ten million men in four years but man's psyche did it *and it can do it again*. I am afraid of one thing only, the thoughts of people, I have means of defence against things'.

The following resolutions, put forward from the chair, were passed by the meeting:

'This meeting while pledging its support to every united effort which can be made to abolish methods of warfare which are repugnant to the common instinct of humanity recognizes that the more important objective is the abolition of war itself.

To attain this end it would urge constant and strenuous activity on the part of thinkers and men of science.

In particular it records its opinion that more attention should be given by them to the study of the new economic conditions, which of necessity, accompany the advance of scientific research.

Of equal or greater importance is the study of means for controlling the evil effects of 'mass suggestion' by the more powerful agency of widely disseminated right ideas through the adoption of an international system of education'.

SCIENTIFIC CORRESPONDENCE

Quantum statistics of an ensemble of harmonic oscillators

It is widely believed that the concept of distinguishability of entities in an ensemble is a classical attribute¹. The origin of the belief may be traced in Boltzmann's argument² that when two identical atoms interchange their places in phase space, a new dynamical state is created, because we can follow the movement of each atom continuously during the process of interchange and hence the two states can be distinguished. In quantum mechanics, continuous tracking is impossible and hence Boltzmann's counting process is wrong. This leads to the concept of indistinguishability of atoms. But

atomic ensembles are not the only ones we encounter in statistical mechanics. An alternative example is the ensemble of non-interacting harmonic oscillators of identical frequency, as we find in the Hamiltonian version of electromagnetic radiation field and of the elastic waves in a solid in the harmonic approximation. In working out the statistical mechanics of these ensembles, we have a dilemma. Do we consider them as distinguishable or indistinguishable entities? The question is significant because in this case the entities are not real objects, they are mathematical constructs. Here, appeal to mechanics does

not help. The only way to decide the question is to work out both the distinguishability and indistinguishability statistics and see which one is consistent with thermodynamics. In the atomic systems we know that distinguishability leads to Gibbs' paradox. The correct statistics is either Bose-Einstein (B-E) or Fermi-Dirac (F-D).

Here, we show that a reverse situation arises for an ensemble of harmonic oscillators. If we treat the oscillators as indistinguishable, we arrive at a paradoxical situation – internal energy is no longer an extensive quantity. The correct statistical mechanics is arrived at