Dr D. D. Burgess (Imperial College, London) explored a new approach based on the laws of conservation of energy and momentum which helps to define the basic assumptions and limitations of other theories. Dr Gillian Peach (University College, London) presented accurate quantum mechanical calculations of electron-scattering cross-sections required for impact broadening theory; her results agreed with semi-classical calculations, but less well with experiment.

The theory of spectral line broadening is very important in astrophysics. Dr B. E. J. Pagel (Royal Greenwich Observatory) described its application to visible effects in stellar spectra (for example, the forbidden satellite lines of helium) to the determination of stellar temperatures and gravities from hydrogen-line profiles and to abundance determinations in stellar atmospheres. The vexatious problem of solar iron abundance, in particular, was closely tied to uncertainties in collision broadening. The helium satellites also formed the subject of a laboratory investigation described by Mr C. J. Cairns (Imperial College, London) which gave results agreeing well with the theory (although theorists are not agreed about its validity). In a similar vein, Dr A. N. Prasad (University of Liverpool) showed how both temperature and density of a hot plasma could be deduced from the profile of He II $\lambda 4686$.

ATOMIC BEAMS

Relativity in Action

A NEW method devised to measure the velocity of a beam of atoms exploits the relativistic relationship between an electric and a magnetic field and seems to be significantly more accurate than the usual method based on the time of flight. T. S. Stein *et al.* (*Appl. Phys. Lett.*, **16**, 1; 1970) have passed a beam of sodium atoms through a region containing electric and magnetic fields, and by comparing the magnetic effect of the electric field with a known magnetic field they have obtained an accurate measure of the mean velocity of the beam.

It is rare to find a relativistic effect that is of value at velocities as low as 10^4 cm/s, or one millionth the velocity of light. The basis of the method is to apply a constant magnetic field to separate the energy levels of the atoms, followed by a radio frequency field divided into two separate coils. Transitions of the normal Zeeman type are induced and an interference pattern appears in the counter. The magnetic effect of the constant electric field is then to shift the position of the interference pattern, and by adjusting the counter to monitor the position of largest slope on the pattern very small shifts can be detected.

Stein *et al.* point out that this method can be refined to a high degree of precision. Increased accuracy is obtained by continuously reversing the electric field, and by varying the magnetic field a plot can be obtained which gives the mean velocity of the beam as its slope. A weakness of the system, however, is that the mean velocity only is measured, whereas with time of flight techniques the whole velocity distribution is obtained.

The relativistic method was devised as a byproduct of an experiment to measure the electric dipole moment of alkali atoms, and Stein *et al.* have used it on both sodium and caesium atoms. What other particles may be tracked by this method? One suggestion is that a new attempt might be made to see if the neutron possesses a small electric dipole moment. Although no such moment would be expected, the uncertainty in nuclear conservation laws suggests that such a search may indeed be profitable.

GEOPHYSICS

Earth and Oceans

from a Correspondent

THE boom in Australian minerals provided the central theme for the international conference on geophysics of the Earth and oceans, held in Sydney from January 19 to 23, when the emphasis was on exploration. Dr F. S. Grant (Kenting Exploration), outlining the role of mineral exploration over the next ten years, stressed that, as in petroleum geophysics research in the past ten years, developments in mining geophysics would be due to refinements in data processing and techniques of interpretation, rather than any marked advances in instrumentation or field techniques.

Mr M. Talwani (Lamont–Doherty Geological Survey), who explained the principles of satellite navigation and the future world wide VLF–Omega system, presented case histories which were a favourable comment on the use of such methods in deep water geophysical surveys. The value of remote sensing techniques was brought out particularly by Mr R. Bennett (Geophoto Services), who showed how knowledge of the relative concentrations of isotopes in different formations can be used as an aid to delineating lithology by airborne gamma ray spectrometry.

Induced polarization is a very important exploration tool in Australia. Case histories reviewed by Dr S. H. Ward (University of California, Berkeley) indicated that best resolution could be obtained using the dipole–dipole array, and that the percentage frequency effect was to be preferred to the metal factor as a useful diagnostic parameter. Mr G. Omnes (Compagnie Générale de Géophysique) pointed out that induced polarization is the only satisfactory electrical conduction method to delineate massive and disseminated sulphides in areas of West Australia where there are low resistivity overburdens.

When attention turned to magnetism, Dr N. C. Steenland (GAI–GMX, Texas) showed how successful aeromagnetic surveys have been in the search for petroleum fields. He has found that an interpretation based on raw magnetic data is often more significant than results obtained from complex data analysis. Mr G. A. Young (Bureau of Mineral Resources) derived a geological map from airborne magnetic data, and on it the disposition of greenstone belts was clearly indicated, highlighting the interesting areas where the search for base metals should be concentrated.

Naturally, no geophysical conference would be complete without a discussion of continental drift. A special session on rock and palaeomagnetism was introduced by Professor S. K. Runcorn (University of Newcastle upon Tyne) with a general lecture on continental drift, mantle convection currents and tectonics. Mr G. Luck and Mr M. W. McElhinny (Australian National University) presented the first definitive palaeomagnetic results for Australia and India for the Lower Palaeozoic era. Their reconstruction of Gondwanaland was in general agreement with previous theories.