fect exploit its variation with frequency to discriminate against rotations originating in other ways.

There are detailed variations in the experimental methods adopted, but the principle is always the same; the atomic vapour is contained in an oven between nearly crossed polarizers. The light source is a tunable laser. The optical rotation is found from the intensity transmitted through the system which depends on the laser frequency and on the number of atoms in the line of sight. The latter is found from the Faraday effect, the rotation induced by an applied axial B-field.

The method is very sensitive but it is difficult to discriminate against spurious effects. It is amusing to reflect that a measurement accurate to about 10% could be carried out in less than a minute if one were limited only by noise in the signal. In fact, some of the optical rotation experiments have been going for well over 10^6 minutes and this accuracy has still not been reached. So far, measurements have been made at 648 nm and 876 nm in bismuth and 1.28 μm in lead; all groups involved have found optical rotations of the order of magnitude predicted, the quoted experimental uncertainty ranging from 15% to 30%. The bismuth 648 nm transition is of particular interest since it is the only atomic PNC experiment for which results have been reported from different laboratories, at Oxford, Moscow and Novosibirsk. Until quite recently, all three disagreed completely. The latest data from Moscow and Oxford are consistent while the Novosibirsk group still quotes an effect of about a factor of two larger. Whatever the final outcome, this shows the importance of cross-checks between different laboratories when such small effects are being measured and the possibility of significant systematic error is so difficult to exclude. A further useful comparison will be possible when the Oxford group obtain a result for the 876 nm transition in bismuth, already studied in Seattle. Checks of the fluorescence experiments are provided by the consistent results obtained when techniques have been varied and when different hyperfine transitions have been studied. However, even here confirmation of the results from other laboratories would be valuable.

At the same time, it does now seem likely that the major problems in the various experiments have been recognised, and that before long the atomic physics data will be accurate to 10% or better. We therefore turn again to the question of the motivation for all this effort.

From the elementary particle point of view, the interest is in the measurement of the coupling constants. As mentioned before, the heavy atom results depend mainly on one component of the neutron-electron interaction, but one can write down the exact combination of quark-lepton coupling constants which determines the PNC effect in any given case. The first point to make is that the combinations measured in the heavy atom experiments are almost orthogonal to that obtained in the electron scattering work at SLAC. The various methods of studying the electro-weak interaction are complementary, and taken together can in principle distinguish between different gauge models.

How far "in principle" can become "in practice" depends critically on the accuracy of the atomic experiments. For example, if the combined uncertainties in the experiments and atomic theory can be brought below 10%, one can derive a value of the Z^0 mass with a precision comparable with that of the existing CERN result. If it is possible to reach the level of a few percent, the experiments even become sensitive to radiative corrections to the theory. Furthermore, one may eventually hope to observe nucleon spin-dependent effects and even perhaps the electron-electron interaction. However, there is one major difficulty to be overcome, which is to solve the atomic problem well enough to derive the coupling constants from the measured PNC effects to a precision comparable with the expected experimental accuracy. Even for the comparatively simple systems of caesium and thallium, the accuracy of the calculations is hard to assess, though errors below 15% have been quoted. This theoretical work, is now being pursued vigorously, one object being to compare the results of several different approaches to the same problem. This should give some feeling for the reliability of the calculations and how best to go about them. One may look for significant improvements over the next few years so the prospect of a critical comparison between high and low energy data looks promising.

Nevertheless, it is important to stress that the interest of the field is more general than this. Naturally, atomic physicists hope that their measurements of PNC effects will contribute to our understanding of the basic physical laws; it is reassuring to find that the atom still maintains its role as a natural testing round for new theoretical concepts. The theories developed to account for high energy phenomena often seem to have little relevance outside the domain of giant accelerators, and it is striking that the familiar atom, which is often said these days to be completely understood in principle, should be so profoundly affected by the existence of the weak neutral current. However, quite apart from these fundamental considerations there have already been major benefits from this field of study. New experimental techniques have been developed which have applications in quite different fields. Also, as already remarked, the need for theoretical progress has stimulated considerable activity which will give insights into the description of many other atomic phenomena. There is something of a temptation to assume that PNC effects are only interesting in so far as they might influence elementary particle theory. This is nonsense; the fascination of the great majority of atomic phenomena depends not at all on their capacity to change our views on fundamental interactions. The idea of atoms without reflection symmetry is a strange and beautiful one in its own right, and must surely rank as one of the most striking developments in the distinguished tradition of atomic physics.

Further Reading

The field has been reviewed by Fortson E.N. and Wilets L. in *Advances in Molecular Physics* **16** (1980) 319.

A shorter account containing references to more recent work is given by the present author in *Acta Physica Polonica* **A66** (1984) 4, 377.

Bouchiat M.A. and Pottier L. have given an account for non-specialists in *Scientific American* **250** (June 1984) 6, 76.

Europhysics Letters

Editor-in-Chief

Following discussions throughout the European Physical Society — the Divisions, the national societies, members of Council and the partners investing in the journal — Nicholas Kurti of Oxford has been invited by the Executive Committee to become the first Editor-in-Chief of the EPS general physics letters journal to be launched in January 1986.

He has accepted and with characteristic energy and enthusiasm begun to grapple with the questions raised by the implementation of the structure that has been agreed. Readers will recall that this comprises a body of Co-editors each directly responsible for accepting or rejecting submitted letters in a given subject area, supported by a group of Advisory Editors with wide geographical and subject background.