about its structure from electron, muon or neutrino scattering. But muon-pair production from pion beams, when interpreted in the Drell-Yan picture, agrees well with theoretical prejudices about the momentum distributions of quarks within the pion. Quarks are known to have spin ½ and at values of the invariant mass *m* high enough for scaling to have set in, the angular distribution of the produced muons is found by the Chicago-Illinois-Fermilab collaboration to correspond with that predicted from the fusion of a pair of particles of spin ½.

One surprising property of the Drell-Yan continuum was discovered by the Columbia-Fermilab-Stony Brook collaboration. It was expected that the dilepton system would emerge from the reaction with its total momentum in a direction closely parallel to the incident beam momentum, but it is found that rather often this is not so. Theorists would like to interpret this as a natural consequence of quantum chromodynamics. This is believed to be the quantum field theory associated with the strong interactions that hold quarks and antiquarks together within protons and pions. Just as in quantum electrodynamics the electromagnetic force is transmitted by a particle, the photon, so in quantum chromodynamics the strong force is

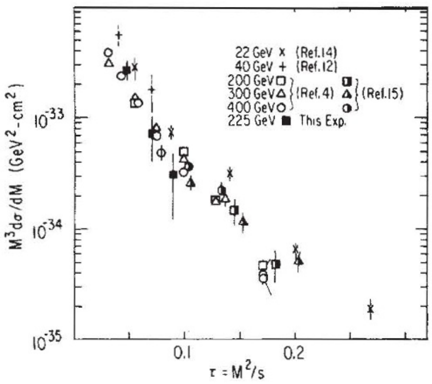


Fig. 3. Test of scaling: plots of $m^3 d\sigma/dm$ for various energies of the incident proton beam (Chicago-Illinois-Princeton). From Anderson *et al. Phys. Rev. Lett.* **42**, 944; 1979).

thought to be transmitted by a particle called the gluon. The bremsstrahlung of gluons by the quarks and antiquarks before they fuse can appreciably change their directions of motion, and so may account for the large transverse momentum component of the dileptons. If this is the correct explantion, the gluon bremsstrahlung will have other consequences that can be checked in accurate experiments, including small but well-defined deviations from scaling and from the simple expectations for the angular distributions. The strong interest of both experimentalists and theorists in the Drell–Yan mechanism seems likely to continue. □

A new form of electron diffraction by atoms

from C. B. Lucas

STUDIES of electron scattering by free atoms have now over 50 years of history, so it is surprising that a new diffraction phenomen has just been discovered by Geiger and Morón-León (*Phys. Rev. Lett.* **42**, 1336; 1979).

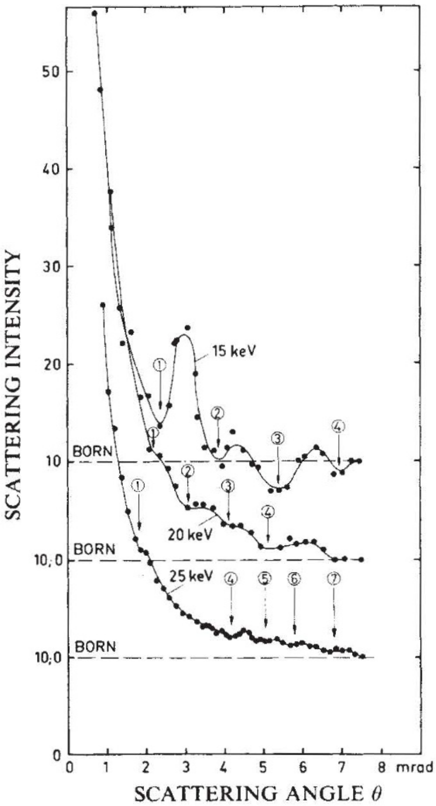
The first experiments which showed that electrons have a wave nature and so undergo diffraction effects were those of Davisson and Germer in 1927, using a crystalline taget. These experiments overshadowed the studies of electron scattering from free atoms which started at about the same time. As Bullard and Massey stated in 1931: "It will be seen that the . . . curves exhibit general similarity to those representing the intensity of light scattering from small spheres . . . However the analogy must not be pushed too far as the electron wavelength varies very rapidly in the region of the atom."

In so well-established a field, little general interest is aroused by the majority of current publications on elastic electron scattering. Recent progress has mainly been directed towards increased accuracy of experimental data and increasingly sophisticated numerical calculations. Though great interest was aroused by the discovery of resonance phenomena, which caused narrow structure to be seen in the scattered intensities, certainly the most outstanding discovery of recent times was also made in the 1960s — that electrons scattered from heavy atoms are spin-polarised. This confirmed predictions made by Mott in 1929, using the relativistic form of the Schrödinger equation, which had been introduced by Dirac only a year earlier. Even this exciting discovery did little to raise the prestige of elastic electron scattering studies as very few surprises emerged. Also, the unfortunate fact was soon discovered that large values of polarisation were only obtained in the scattering minima. This is because the polarisation is caused by an angular displacement of the scattered intensity for electrons of different spin directions, but the maxima are broad and thus insensitive to the displacement. In other words, electron scattering has only yielded very small currents of polarised electrons, so interest in ways of producing polarised electrons rapidly switched to other fields.

The electron scattering maxima and minima are found at electron energies ranging from a few electron volts up to many hundred, especially in the heavier atoms. Quite deep minima in the scattering intensities are observed at scattering angles ranging from beyond the forward peak to well into the backward scattering region.

The new electron diffraction was discovered by Geiger and Morón-León at higher electron energies and at scattering angles of less than 0.5°. It occurs not by diffraction on the atom itself but from a kind of shadow around the atom produced by other scattered electrons. This diffraction had not been predicted theoretically, although the reason for its occurrence is easily understood.

In general, the intensity of electrons which are scattered elastically at any scattering angle is larger than the intensity of electrons which have lost some of their energy, for example by exciting or ionising the atom. These inelastically scattered electrons, however, dominate the forward scattering, especially at high energies, where their intensity is typically 1000 times greater than the elastic. So if only the



Shadow diffraction in neon at electron energies of 15, 20 and 25 keV. For clarity the three curves have been displaced and the orders of the diffraction minima have been numbered.

THE statement on page 4 of the *News and Views* article prepared by Leffert and Koch, entitled 'Ionic Landmarks Along the Mitogenic Route' (*Nature*, **279**, 104; 1979) is incorrect. Proteolysis does not convert myelin basic protein into a mitogenic peptide whose sequence is Thr-Pro-Pro-Pro-Ser-Gln-Gly-Lys. What I stated at the conference was that from our data the brain FGF activity resides within region 91-117 of the basic protein. However because of the effects of other portions of the molecule on mitogenicity one would not expect that this region itself would be mitogenic.

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