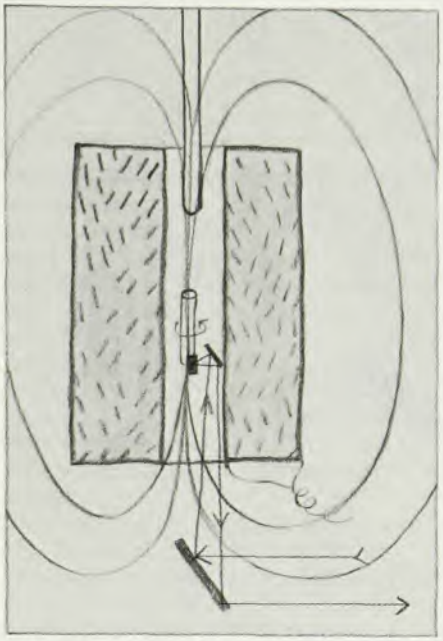
letters

Simplifying physics history

At the time of his death this March (see page 75) John Quincy Stewart was best known for his work in social physics, which used concepts from potential theory and kinetic theory as aids in understanding demography and economic geography. It is less known that in the years from 1915 to 1917 Stewart measured the gyromagnetic ratio of the charge carriers that cause permanent magnetism in iron and nickel.[1] This was done by magnetizing a suspended iron or nickel wire along its length, then demagnetizing it and measuring its angular recoil. For iron the result was $(0.51 \pm 0.04)(2m/e)$, and for nickel $(0.47 \pm 0.11)(2m/e)$, or about half what it would have been had the charge been carried by the orbital motion of electrons.

It was an important discovery, for it helped to start one of the trails that led to the concept of electron spin. It was a difficult experiment that reflected great credit on the experimenter. Yet generically the procedure is called the Einstein–de Haas experiment, and probably most physicists believe that the unexpected gyromagnetic ratio was discovered by Einstein and W. J. de Haas. In fact, the basic scheme was suggested by O. W. Richardson in 1907,[2] and was attempted several times in the Princeton Physics Department. Stewart's experiment was the first of these attempts to work. Though Einstein and de Haas did the experiment in 1915,[3] they did not make the vital discovery. Their measured gyromagnetic ratio was too high, and they concluded wrongly that ferromagnetism was caused by orbiting electrons. Their experiment was slightly different from Stewart's in that it used repeated reversals of magnetization to set the sample into resonant oscillation on its suspending fiber. An experiment by de Haas alone in 1916[4] led to the same wrong conclusion. Finally, in the hands of E. Beck[5] the resonance method gave the right answer in 1919.

S. J. Barnett[6] anticipated Stewart's discovery in 1915, but later recanted.[7] In doing the inverse experiment, that is, rotating an iron bar at high speed and measuring the resulting magnetic



moment, he first found the gyromagnetic ratio to be half the expected value. But on repeating the experiment in 1917 he found it to be higher and declared it consistent with orbiting electrons.

Stewart's relative eclipse falsified the scientific history of the time. Whatever name the experiment bears now, it was Stewart, and, in spite of his recantation, Barnett, whose data started people thinking. See, for example, A. H. Compton's 1921 paper[8] proposing a spinning electron.

Stewart, and to a lesser extent, Barnett and Richardson have been overshadowed by the magic of Einstein's name. The natural assumption that whatever Einstein did he did better than anyone else is in this case wrong, and has led people to overlook good work by other good physicists.

This is a common phenomenon in science, more the rule than the exception. It happens because science cannot, in a sense, ever know its own past, and synthesizes a false history to fill the gap. We can never be sure what led someone to make a particular discovery: sometimes he does not know himself. We can, if we try, often find out who did what, and when he did it. But the interconnections between scientists, the *why* of who did what, are a great boiling uncertainty.

As scientists we want to know our place in the universe, so we create a history simple enough to understand, one populated by a small number of infallible giants who build, step by logical step, on each other's contributions, and do everything that matters.

This tidy synthetic picture is both unfair and dull. It sweeps out of sight the genuine drama, the successes and failures, of brilliant men, such as Stewart, well worth our attention and respect.

References

1. J. Q. Stewart, Phys. Rev. **11**, 100 (1918).
2. O. W. Richardson, Phys. Rev. **26**, 248 (1908).
3. A. Einstein, W. J. de Haas, Deut. Phys. Gesell. **17**, 152 (1915).
4. W. J. de Haas, Deut. Phys. Gesell. **18**, 423 (1916).
5. E. Beck, Ann. der Phys. **60**, 109 (1919).
6. S. J. Barnett, Phys. Rev. **6**, 239 (1915).
7. S. J. Barnett, Proc. Nat. Acad. Sci. **3**, 178 (1917).
8. A. H. Compton, J. Franklin Inst. **192**, 145 (1921).

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Missing names supplied

A total of 29 letters were sent in by readers in response to our challenge to name the unidentified faces in the group picture published in the December issue (page 9). The following names can now be added (or corrections made) to the list originally published (refer to December issue for numerical key):

17. Reginald J. Stephenson
25. Wave H. Schaffer
28. Carole Rieke
31. —Peck
32. Alois Bragagnolo (shop)
34. Omar Polk
37. Eula Snyder Wager
38. Fritz Dietz