In this issue

A weighty matter

The gyroscope, which is really a top when spinning fast, exhibits a most peculiar property of pointing to the same direction in space, irrespective of any movement of the base on which it is standing. It has therefore found important applications in terrestrial navigation and celestial navigation. This behaviour, although it appears mysterious, is explained on the basis of the principle of conservation of angular momentum, which is an extension of the classical law of the conservation of linear momentum. Classical physics does not allow the generation of a single force without a reaction. The weight of a gyroscope should therefore be independent of its rotational speed and whether or not it is spinning; nor should it vary whether the spin (angular rotation vector) is directed upwards (against the direction of the earth's gravitational field) or downwards. But this is exactly what the experiments of Hayasaka and Takeuchi of the Tohoku University found (*Phys. Rev. Lett.*, 1989, **63**, 2701). If true the result would overturn the foundations of classical physics. Indeed one could even dream of applying this strange effect to space travel.

The experiment that was performed was extremely simple: a plain gyroscope sitting on a pan of a laboratory balance with its rotor vertical was reported to exhibit an apparent loss of weight when its spin axis was pointing towards the centre of the earth and no loss of weight when the spin axis was pointing away. For a 175-g rotor at 13,000 rpm the loss of weight was about 10 mg, many times the claimed accuracy of the balance (0.3 mg). The loss was also proportional to the first power of the rotor mass and the angular velocity. All the possible precautions to eliminate interfering effects were taken (the enclosure was evacuated, the frame of reference inverted, magnetic screening, etc.).

There is no way in which the observation could be explained within the limits of classical mechanics. Spin–spin coupling between the rotating gyroscope and the earth of the type allowed by a variation of Einstein's theory of gravitation could be evoked; unfortunately the measured effects are too large. The theorist may go to town thinking even of effects due to neutrinos which are chirally asymmetric.

Publication of the results evoked criticism of the refereeing system and discussion on what a journal should do when the conclusions are so much contrary to current beliefs. What does the referee do when the data appear so good they will normally be accepted in less controversial fields? The editor of *Physical Review Letters* did (in our view) the right thing by just publishing the paper. Though this seems all right (for the authors, referees and editors), according to the editor of *Nature* (1990, **343**, 113), it is thoroughly unsatisfactory 'for the other interest group vividly engaged in the publication process—the readers'. We feel that while editors and referees must do everything to see that no papers with obvious errors are published in their journals they should not think that they are the final arbiters of what is ultimately correct in science. (Imagine stubborn editors/referees not publishing the result of the Michelson and Morley experiment as it contradicted conventional wisdom!). When in serious doubt all that editors can do is to expose the paper to the scientific public. This will immediately provoke new experiments which will confirm or contradict the unusual result by independent measurements.

This is what has happened in this case. Three groups, from India (C. S. Unnikrishnan, **page 600**), France and the US, repeated the experiment and obtained a null result: the mass of the spinning gyroscope is not dependent on speed or sense of rotation. For example, Unnikrishnan finds that there is practically no anomalous weight reduction. The effect is lower by a factor of 60 than that claimed earlier and any weight change which could depend on the magnitude of the spin is constrained to 2 parts in a million.

There have been speculations as to where error crept into the Japanese experiment (see *Nature*, 1990, **343**, 509).

A case of costs

We in India who also publish journals are watching from the sidelines the drama that is developing in the US and elsewhere in the 'business' of scientific publication. Scientific publishing involves big money. A reputed publishing company has sued three learned societies (**page 584**) for publishing a researched paper which indicates that the journals published by this company are among the most expensive in terms of ratio of cost to volume of scientific material published and ratio of cost to impact index (in terms of citation). Barschall, a reputed US physicist, carried out this interesting study; he too has been sued by the publishing house. We are told that any scientist who dares to write a letter to any journal complaining of the high cost of certain journals is apt to receive a communication saying that steps would be taken against him/her and also against the journal that publishes the letter 'to protect our clients' interests'. We are also told that this company has requested the Foundation of Scientific Cooperation in England to develop criteria for future surveys to assess the relative cost-effectiveness of scientific publications. There is some suspicion that funding for this impartial study may come from the same company, although this has been denied.