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international reputation in physical and analytical chemistry, specifically for his work on the accurate determination of the atomic weights of oxygen and hydrogen (as they combine to form water), he received honors from several prestigious societies, including the Davy Medal of the Royal Society of London.

Self-educated in both fields, Morley was just as much a physicist as a chemist; he was an experimentalist who was extremely meticulous and widely experienced. These were the attributes that prompted Michelson to choose him for collaboration in the ether drift study and two other significant works. Knowledgeable in the ancient languages through his ministerial studies and fluent in the modern ones through his scientific work, having an interest in classical and religious music, and imbued with a thirst for learning and significant achievement in basic science, Edward Williams Morley was indeed a remarkable 19th-century scholar and cultured gentleman.

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A Modern Test for the Ether?

Bearing in mind that the Michelson–Morley experiment sought to detect the ether and that Albert Einstein could not dissuade Albert A. Michelson from his lifelong belief in the ether,[1] I feel we ought not to pay our tributes on this centennial of the experiment by merely classifying it as one among many of the tests supporting Einstein's theory of relativity.

Michelson's spirit lives on in the minds of many who intuitively feel that the right experiment can detect our motion through the ether. Assuming that there is an ether, we should, as part of our reassessment at this time, probe the reasons why the Michelson–Morley apparatus gave a null indication.

Mark P. Haugan and Clifford M. Will in their article "Modern Tests of Special Relativity" (May 1987, page 69) deal with the light-speed anisotropy issue by reference to Lorentz invariance. They do not consider the causal viewpoint that physical resonance effects, for example, might affect the interpretation of the Michelson–Morley experiment.

It is crucial to realize that Michelson and Edward Morley were basing their test on the assumption that light waves travel freely at a speed set by an absolute frame of reference. Yet it was a few years later that Otto Wiener discovered that waves reflected through 180° by a mirror interact with the incident waves to set up standing waves that have their nodes locked into the mirror surface. This means that the energy in these waves is dragged through space by the apparatus and has no freedom to deploy along the beam at the mirror interface.

Assuming that the incident and reflected waves travel freely without affecting one another's wave velocity, owing to their energy fields, these standing waves would oscillate with a phase varying along the beam as a linear function of the speed at which the apparatus moves through space. However, if the effect of retro-reflection at a mirror intrudes as a barrier to energy adjustments it can force a situation that precludes such phase variation. This is likely on symmetry grounds, and it means that, relative to the mirror, the light speed is forced to become the same in either direction along the beam.

One can debate whether this action occurs in deference to Einstein's theory or, as I suggest here, is a causal physical process resulting from a kind of resonance. Either way, however, it is inappropriate to assume that waves can travel freely when their standing wave oscillations are anchored to a mirror surface. The null result of the Michelson–Morley experiment could well be nothing other than a forced condition in the apparatus, and perhaps such nulls arise in other experiments that are conducive to similar resonance effects.

In these circumstances, Michelson's belief in the ether can still be tested by experimental configurations that aim to avoid setting up standing waves that are completely in phase along the test length. This means avoiding the 180° retro-reflection in the beam path. Michelson and Henry G. Gale used such a configuration and, consistent with the Sagnac experiment, which used an interferometer in which the light paths traversed the same loop in opposing directions, detected Earth rotation as if there were an ether.[2] Therefore, so far as detecting a rectilinear motion through space is concerned, the last word on the Michelson–Morley type of experiment will not have been said until tests have been made to verify any phase modulation of the standing wave along the beam length.

In principle, such an experiment is feasible with a beam configuration that only partially comprises an in-phase standing wave oscillation and partially comprises one of varying phase—both at the same frequency and with the same laser source. This should give standing wave amplitude modulation along the beam at a frequency that is linearly related to our speed through space.

Indeed, an experiment that appears to operate on this principle has already been reported[3] and its preliminary findings indicate a positive measure of light-speed anisotropy commensurate with motion through space at 378 km/sec. It is of course all too easy to discredit such claims in view of the overwhelming evidence supporting the theory of relativity. However, in deference to Michelson's conviction about the ether, as shared by Morley, 1987 is perhaps a time when we should be more open to such possibilities. Certainly, if the experiment just mentioned were to hold up at a time when the Michelson–Morley centennial is being celebrated, it would be a remarkable event in the history of physics.

References

1. M. W. Browne, The New York Times, 28 April 1987, p. C1.
2. A. A. Michelson, H. G. Gale, Astrophys. J. 61, 14 (1925).
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Crystallography's Historical Struggles

It is unfortunate that the rigor we seek in our physics is often less evident when we discuss the history of our subject. A significant number of recent letters to the editor have been related to this matter. I refer particularly to the letter headed "Crystals and Nobels" that appeared in the February 1987 issue (page 9).

The author counts 21 Nobel Prize winners whose research has been associated with x rays and crystals, and then draws conclusions regarding the odds of crystallographers winning the award. This sleight of hand is revealed by the list that then follows, which suggests that Wilhelm Röntgen, Charles G. Barkla, Manne Siegbahn and Arthur H. Compton (among the physicists) can be regarded as crystallographers, simply because their prizewinning work concerned x rays.

Similarly, the chemistry award to Peter Debye in 1936 was for his contribution to the study of molecular structure through his investigations of gases. Apart from the award to