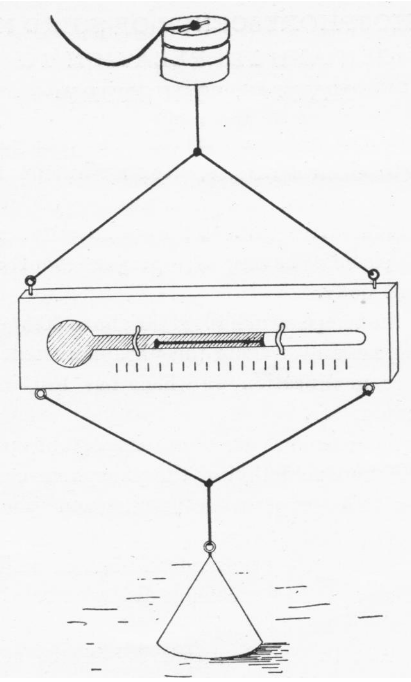

line is slack. Before lowering, the thermometer must be tilted so that the pin touches the meniscus. As the column contracts it is drawn back and left behind on subsequent expansion of the column as the thermometer reenters a zone of higher temperature. In the figure the size of the thermometer is exaggerated. In practice the distance from the thermometer to the sinker should be about a yard. On lowering, the bottom will be felt as in an ordinary sounding; and the observer has merely to wait a few minutes and haul up, the pull of the float maintaining the horizontal position throughout.

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## A SPECIMEN MOUNT FOR INSECTS AND OTHER OBJECTS OF NATURAL HISTORY, ETC.

THE following description of a method of making permanent mounts of natural history specimens is based on work done at the Bermuda Biological Station in January to March in 1933, the plan being adopted during January with trials of different manipulations and with tests of the availability of each.

A dry cell is made by punching the center of a cardboard, bristol-board or similar material of different thicknesses or, where necessary, by building up to desired thickness by assembling several together, and then gluing a proper sized sheet of Cellophane to one side with duco or Cellophane adhesive, making a cell of sufficient depth to accommodate the object to be preserved. The cell and the object are dried by warmth and then the cell closed by applying adhesive to the upper side of the card and drawing the Cellophane down over the cell and pressing it to make a smooth adhesion and, if desired, turning a lap over on the under side and closing the ends by laps of the Cellophane. This makes a mount that is completely enclosed by moisture-proof Cellophane protected from mold, moisture, insect pests or other sources of deterioration and is especially applicable for insect or other collections in tropical or humid climates. Specimens so mounted are available for immediate and convenient examination or study with lens or microscope, either compound or binocular, and can be studied from either side or even at a considerable angle, since the thin layer of Cellophane does not interfere with extremely close study. Records or labels placed on the cards before sealing are also permanently protected by the transparent covering. Specimens mounted in this manner during January and exposed for a number of weeks to the attacks of ants, cockroaches and other pests and also to molds have shown no traces of injury, and it is believed that they will maintain their condition for an indefinite period. Delicate insects like mosquitoes and parasitic hymenoptera as well as insects of larger size are kept in perfect condition.

These mounts have been observed by a number of workers at the Bermuda Biological Station and have also been shown to a number of other specialists and all have agreed that the method seems to have a wide application and to be worthy of special notice.

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# SPECIAL ARTICLES

## THE ABSOLUTE MOTION OF THE SOLAR SYSTEM AND THE ORBITAL MOTION OF THE EARTH DETERMINED BY THE ETHER-DRIFT EXPERIMENT[1]

THE ether-drift experiment, first suggested by Maxwell in 1876 and made possible by Michelson's invention of the interferometer in 1881, though capable of being applied to the detection of the general absolute motion in space of the earth, was actually arranged for detetcing only the known orbital component of the earth's motion. For the first time, in 1925 and 1926, at Mount Wilson, the writer made observations of such extent and completeness that they were sufficient

[1] Read before the National Academy of Sciences, Washington, D. C., April, 1933.

for the determination of the absolute motion of the earth. These observations involved the making of about 200,000 single readings of the position of the interference fringes, and lead to more than 25,000 single values of both the right ascension and declination of the apex of the motion.

The ether-drift effect in the interferometer, as is well known, is a second order effect, and the observations correctly define the line in which the absolute motion takes place, but they do not determine whether the motion in this line is positive or negative.

At the Kansas City meeting in December, 1925, before the completion of the Mount Wilson observations, a report was made showing that the experiment gives evidence of a cosmic motion of the solar system, but which failed to identify the effects of the orbital motion, though it seemed that the observations should have been quite sufficient for this purpose.[2]

In the autumn of 1932, a reanalysis of the problem was made, based upon the alternative possibility that the motion of the solar system is in the cosmic line previously determined, but is in the opposite direction, being directed southward. This gives wholly consistent results, leading for the first time to a definite quantitative determination of the absolute motion of the solar system, and to a positive detection of the effect of the motion of the earth in its orbit.

The apex of the cosmic motion of the solar system is located in the right ascension of 4 h., 56 m., and in declination 70° 30′ south, diametrically opposite the apex previously announced. The velocity of the cosmic motion is determined by comparison with the known velocity, 30 kilometers per second, of the earth's orbital motion, and has the value of 208 kilometers per second. For some unexplained reason the observed displacement of the interference fringes in the interferometer corresponds to about one twentieth of the full velocity. This might be accounted for by an incomplete Lorentz contraction, or by Stokes's theory of a dragged ether.

The location of this apex is in the southern constellation Dorado, the Sword-Fish, and is about 20° south of the star, Canopus, the second brightest star in the heavens. It is in the midst of the famous Great Magellanic Cloud of stars. The apex is only about 6° from the pole of the ecliptic; thus the indicated motion of the solar system is almost perpendicular to the plane of the ecliptic. This suggests that the solar system might be thought of as a dynamic disk which is being pulled through a resisting medium, and which therefore sets itself perpendicular to the line of motion.

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2 SCIENCE, 63: 433–443, 1926.

## THE PHOSPHORESCENCE OF SOLID NITROGEN AND ITS RELATION TO CRYSTAL STRUCTURE[1]

IN 1924 it was shown that solidified nitrogen, when exposed to electric rays, emitted an intense luminescence, consisting of bands, a number of which remained in the afterglow. Thus we have the case of a chemical element having the properties of a phosphorescent body.

When the temperature is raised above 35.5° K, solid nitrogen passes over from the phosphorescent $\alpha$-form to another modification $\beta$, which has lost its phosphorescent power.

This phenomenon gives an important point of attack for the elucidation of the phosphorescent process. For this purpose the luminescent phenomena were analyzed and interpreted, and secondly the crystal structures of the two modifications of solid nitrogen were analyzed by means of Röntgen rays.

The analysis of the luminescent band-spectra led to the view that the bands appearing in the afterglow are due to "forbidden" electronic transitions from metastable molecular states. Thus the $\varepsilon$-system emitted from solid nitrogen corresponds to an electronic transition from the metastable A-state to the normal state of the nitrogen molecules.

The Röntgen-ray analysis gave for $\alpha$-nitrogen a cubical structure, where the atoms of the molecular elements are arranged according to the space group $T^4$ and where the molecular axes have fixed positions in the space lattice. This structure lets us understand that the metastable states (which in the gaseous form are soon destroyed) in the $\alpha$-form may be left undisturbed for a time sufficiently long for the forbidden transition to take place.

The analysis of the $\beta$-form was even more difficult, but finally it was found by us and independently by Ruheman that $\beta$-nitrogen has a hexagonal structure and that the elementary cell has dimensions nearly corresponding to a hexagonal closest packing of spheres.

For our problem it was of importance to go a step further and try to find out the positions of the individual atoms; but it appeared that the Röntgen reflections could only be accounted for by assuming the centers of the two atoms of a molecular element fall in the center of the molecules. This means that the individual atoms have no fixed positions and that the molecules rotate in the lattice. The rotating molecules require more space, which is seen from the fact that

1 Read before the National Academy of Sciences, Washington, D. C., April, 1933.