delayed somewhat the carrying out of the program, but fortunately the velocity remained nearly constant for several weeks, until satisfactory observations were secured.

With the spectrograph adjusted for the orange region, which is rich in water vapor absorption, spectrograms of Mars were secured on January 26 and 27 under poor atmospheric conditions, and on February 2 under excellent conditions, our atmosphere on this night being exceedingly dry. Measures of the available water vapor lines on these spectrograms, 8 to 22 in number, establish that they were displaced with reference to the lines of solar origin in the observed Martian spectrum by amounts on the three dates corresponding to velocities in the line of sight of 19.7, 20.2 and 18.3 km. per second; weighted mean value, 19.2 km. The relative velocities of Mars, computed from our knowledge of the orbits of the earth and Mars, amounted to 19.1 km. per second. The dispersion and slit-width employed were such that the water vapor lines originating in our atmosphere and any originating in Mars's atmosphere should have appeared side by side, though not clearly separated. If the absorptions by the two planets were equal, the two sets of lines of equal intensities should, in effect, have appeared as broad lines of double width, and the measured velocities should have been but half the computed velocities. The facts are that the terrestrial lines were not bordered nor increased in width by companion lines. When the micrometer wire was set successively in the positions which Martian absorption lines would occupy, no traces of absorption were found in these positions. In effect, Martian absorption did not exist to such an extent as to be visible in the spectrum, or to influence the measurements referred to.

With the spectrograph adjusted to the so-called "alpha" region at λ 6280, which includes a large number of oxygen absorption lines, two spectrograms were obtained on February 3. The observable oxygen lines, seven and six in number, were displaced with reference to the lines of solar origin by amounts corresponding to velocities in the line of sight of 18.8 and 17.4 km. per second. The velocity computed from the elements of the orbits amounted to 19.1 km. The discrepancy of 1.0 km. is within the unavoidable error of measurement. Here again the terrestrial oxygen lines were not bordered nor doubled in width by Martian lines.

The conclusions to be drawn from this investigation are: The quantity of any water vapor existing above unit area in the equatorial atmosphere of Mars was certainly less than one fifth that existing above Mt. Hamilton under the excellent conditions prevailing on February 2. The air temperature was 0° Centigrade, the relative humidity 33 per cent., the absolute humidity 1.9 grams per cubic meter, and the zenith distance 55°.

Likewise, the quantity of oxygen above unit area of Mars must be small in comparison with that in the earth's atmosphere.

It should be repeated that the rays of light utilized had passed in effect twice through the Martian atmosphere.

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Sebastian Albrecht

Lick Observatory,
University of California,
April, 1910

Societies and Academies

The American Philosophical Society

At the meeting of the American Philosophical Society, on May 20, the following paper was read:

On the Principle of Relativity and its Significance: Dr. Robert H. Hough, University of Pennsylvania.

The question was considered only in its philosophical aspect. The idea was developed from the fundamental concepts of dynamics as formulated by Newton and Hertz, and extended to the field of electro-dynamics and optics. The validity of the principle as a mathematical concept was maintained. The equations of transformation were derived by purely mathematical steps from two initial equations representing experimental laws to the present probable error of observation: and the consequent relations of the distances and times involved and their respective units considered.