represent respectively the magnetic and optical anisotropies of the negative ion present in it. It is significant that the values for the three carbonates are practically the same, as are also the values for the two nitrates.

TABLE I.

Crystal	$(\chi_\perp - \chi_\parallel) \cdot 10^6$	$R_0 - R_e$
$CaCO_3$ (calcite)	4.1	2.94
$CaCO_3$ (aragonite)	4.1	2.41
$SrCO_3$	3.8	2.72
$NaNO_3$	4.7	4.83
KNO_3	4.8	4.32
$KClO_3$	−3.8	2.12

What is remarkable is whereas for the CO_3^{--} and NO_3^- ions the diamagnetic susceptibility along the axis of symmetry is numerically a *maximum*, in the case of the ClO_3^- ion it is numerically a *minimum* along its axis; although optically all the three ions behave similarly.

It may also be remarked that the values given in the table would suggest a positive magnetic double-refraction for the nitrate and carbonate ions in solution, and a negative value for the chlorate ion under the same conditions. Observations are available only for the nitrate ion and are in agreement with the above conclusion. (K. S. Kirshnan and C. V. Raman, Roy. Soc. Proc. **A115,** 549, 1927.) It would be interesting to confirm the negative magnetic double-refraction of the chlorate ion in solution.

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The Production of High Speed Protons Without the Use of High Voltages

A method for the production of high speed protons without the use of high voltages was described before the meeting of the National Academy of Sciences last Semptember (Lawrence and Edlefson, Science **72,** 376–377, 1930). Later before the American Physical Society (Lawrence and Livingston, Phys. Rev **37,** 1707, 1931) results of a preliminary study of the practicability of this method were presented. In this preliminary experimental work 80,000-volt hydrogen molecule ions were successfully produced in a vacuum tube in which the maximum applied potential was less than 2,000 volts, and the conclusion of the experiments was that there are no serious difficulties in the way of producing 1,000,000-volts protons in this indirect manner.

This important conclusion has now been confirmed. A magnet having pole faces nine inches in diameter and producing a field of 15,000 gauss has recently been constructed and with its aid protons and hydrogen molecule ions having energies in excess of one half million volt-electrons have been produced.

The magnitudes of the high speed hydrogen ion currents turned out to be surprisingly large, being in excess of one-tenth of one microampere. The proton currents were about one-tenth this value.

The voltage amplification obtained in the present experiment was approximately one hundred. That is to say, about five thousand volts were applied to the tube for the production of five hundred thousand volt ions. This amplification was limited by the slit system used to select out the high speed ions, and can be greatly increased by better design of this part of the tube.

There can be little doubt that one million volt ions will be produced with intensities as great as here recorded when the present experimental tube is enlarged to make full use of the magnet. This alteration is now being carried out.

These experiments make it evident that with quite ordinary laboratory facilities proton beams having great enough energies for nuclear studies can be readily produced with intensities far exceeding the intensities of beams of alpha-particles from radioactive sources.

Possibly the most interesting consequence of these experiments is that it appears now that the production of 10,000,000-volt protons can be readily accomplished when a suitably larger magnet and high frequency oscillator are available. The importance of the production of protons of such speeds can hardly be overestimated and it is our hope that the necessary equipment for doing this will be made available to us.

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