here sought to be made prominent, that relating to the evolution of heat. Heat cannot come of itself; some other mode of energy must precede it. Suppose all matter in existence to be dissociated, resolved to gas so attenuated that no two atoms touch. It would have "potency" for future development of every form of force, but at that time only one would be in existence—gravity. It could reign supreme only for an instant; obeying the law, it would suffer "conservation," and give rise to motion.

Hence, motion is the second mode of energy, and all the heat that ever existed came later. The only sources of heat known are motion and chemical action, itself a most rapid motion. Gravity caused the movement of original atoms, bringing them near enough to be within the influence of affinity, which acting, conserved heat, the fourth form of force awakened in the evolution of atoms hitherto separated. Or a little heat might have been derived from collision of atoms not having affinity; in either case heat had antecedent forces. Heat is not a primal affection of matter, but secondary; being always preceded by gravity and motion. And molecules must be separated by space in order that gravity can cause motion to appear and vanish in heat. It is not conceivable that primordial dissociated matter should have obeyed any impulse at first, save gravity, then motion, then Chemism, then heat and subsequently all other states of force.

The Nebular Hypothesis seeks to account for the evolution of all solar systems from primordial dissociated matter, requiring as Helmholtz says: "Several cubic miles to weigh a single grain." Nearly all physicists accept this theory, and admit that all existing matter was once in this condition of gas. It seems, by reason of known laws of matter, to be true. Thus, no two atoms coalesced; they were as far apart in proportion to their diameters, as the Sun and Polaris. No ascertained law of nature disputes this theory; and within limits of human knowledge, it must be so. Matter dissociated is in its most primitive condition; and nature begins in simplicity and develops complexity. Matter in fluid states is complex, and shows itself to have been wrought by force. All analogy points to the fact that at one time in the history of matter, its atoms were entirely separated; in which condition no force whatever save gravity was in existence to act thereon.

Yet, strange to say, some advocates of the nebular theory teach that this rare gas was intensely hot! They call it "fire mist,[1]" and aver that it was hotter than the sun is now! We read[2]; "There was a time when the materials composing it (the Universe), were masses of glowing vapor," and "we find that the further we go back into time the hotter the sun must have been. Since we know that heat expands all bodies, it follows that the sun must have been larger in past ages than it is now, and we can trace back this increase in size without limit. Thus we are led to the conclusion that there must have been a time when the sun filled up the space now occupied by the planets, and must have been a very rare mass of glowing vapor." True, the materials of the sun extended into a ball of gas thousands of millions of miles in diameter, far lighter than hydrogen; but the gas was intensely cold. No law of matter or force known to man; nor any analogy in nature leads to the conclusion that the primitive cosmical sphere of atoms was hot. It was cold and dark, neither chemism, heat, or light appeared until gravity made conservation in motion, making chemical action possible. Affinity must have been slow at first, so that heat could not have appeared until after ages of chemical and molecular activity had expired, and heated fluid nuclei begun to condense and shine. The original cosmical mass was as dark, cold and silent as interstellar space is now, and "fire mist" never had a place in nature. If the primeval "glowing vapor" ever existed, then the greatest monument ever reared by man, the "Law of Interaction of Force" falls crumbling to final ruin.

EDGAR L. LARKIN.

NEW WINDSOR OBSERVATORY, Ill., *March* 21, 1881.

[1] Winchell's Geology of the Stars.
[2] Newcomb and Holden's Astronomy, p. 494.

NOTES.

SOLUTION OF STARCH.—Zulkowsky proposes to make starch perfectly soluble in water by heating it to 190° C. along with glycerine. This process is most successful with potato-starch, less so with wheat-starch, and very difficult with rice-starch.

SALICYLIC ACID IN TEXTILE MANUFACTURES.—Dr. F. von Heydon recommends salicylic acid to be applied in dilute solution to woollen yarns, and to be mixed with sizes to prevent mildew, unpleasant smells, &c. Five grms. acid are sufficient for a litre of size.

ACTION OF HYDROCHLORIC ACID UPON METALLIC CHLORIDES.—The chlorides which are rendered more soluble by hydrochloric acid are divided into two groups; the one (*e.g.*, mercuric chloride) exceedingly soluble in the concentrated acid form with it crystalline compounds; the other (*e.g.*, silver chloride) very sparingly soluble, even when heated, yield on cooling the chloride considered as anhydrous.—A. DITTE.

ACTION OF CAUSTIC LIME UPON PURE SOLUTIONS OF SUGAR AND RAW BEET-JUICE.—If free alkalies or alkaline earths are added to a solution of sugar the rotation which sugar occasions in polarized light decreases, and is restored on neutralizing the alkaline liquid with acetic acid.—F. DESOR.

NEW STUDIES ON THE PART PLAYED BY BONE-BLACK IN THE SUGAR MANUFACTURE.—Free lime is almost entirely absorbed by bone-black. Salts of lime and potash are also absorbed to a certain extent. Potash and lime, the latter in saline form, promote each other's absorption.—H. PELLET.

CHEMICAL CHANGE OF STARCH ON EXPOSURE TO STEAM AT A HIGH PRESSURE.—A heat of 140° to 150°, and consequent pressure of 3½ to 4½ atmospheres convert 71 per cent. of starch into glucose. Dr. M. Stumpf considers that with the aid of 1 to 2 parts of acid per thousand saccharification may be carried so far as to render the use of malt unnecessary.

DECOMPOSITION OF SALTS BY LIQUIDS,—The laws of dissociation by heat, applicable to the decomposition of salts by pure water and saline acid solutions, apply also to decomposition by alcohols.—A. DITTE.

INFLUENCE OF THE SOIL UPON THE TANNIN OF OAK BARK.—A comparison was made between the bark of young oaks grown respectively upon sandy loams, upon peaty soil which had been once burnt, and upon a similar soil thrice burnt. The proportion of tannin was found higher in case of the peaty soils.—M. FLEISCHER.

INFLUENCE OF MANURES ON THE APPEARANCE OF DISEASE AND THE PROPORTION OF STARCH IN POTATOES.—Three plots dressed with stable manure showed 6, 6, and 5 per cent. of diseased tubers. Plots where superphosphate and small quantities of ammoniacal superphosphate were used did not increase the percentage, but with larger proportions of the latter it rose to 8 per cent. Chili saltpetre was attended by a proportion of 11 per cent., and when used as a top-dressing 12 per cent.—M. MARCKER.

INFLUENCE OF BORAX ON THE DECOMPOSITION OF ALBUMEN IN THE ANIMAL ORGANISM.—The ingestion of borax is found to increase the decomposition of albumen.—M. GRUBER.

TITRATION OF BISMUTH SUBNITRATE.—This process is based upon the facts that as to 9·9074 grm. of monohydrated sulphuric acid correspond to 1 grm. anhydrous nitric acid these two weights of acids will require the same quantity of alkali for exact saturation, and that bismuth subnitrate is capable of yielding all its nitric acid to an excess of alkali on boiling.—E. BAUDRIMONT.