

mate which was 40,000,000 degrees.

The number of atoms in the sun is 1,000,000,000,000,000,000,000,000 (ten to the 24th power) and the number of free electrons is at least as great.

The number of X-rays which constitute the internal radiant heat of the sun, total 20,600,000,000,000,000,000,000 (20,600 times ten to the 18th power). Sir Arthur believes that this number is correct within one per cent.

These X-rays are continually absorbed by the atoms and are emitted again and again. Thus energy is conserved and the sun has a long expectation of life.

Sir Arthur considers that it is possible that the sun consists of as much as 99.5 per cent. hydrogen but that a content of 35 per cent. is more probable. The recognition that a large proportion of hydrogen exists in the stars is considered by Sir Arthur to be the most important advance in stellar theory in the last seven years.

As to whether the sun or man-made high voltage can do the most damage to atoms, Sir Arthur is backing the high voltage developments now in progress of which the apparatus at Cambridge's Cavendish Laboratory is typical.

Science News Letter, March 3, 1934

GEOLOGY

Yellowstone Park Has Great New Hot Pool

YELLOWSTONE National Park has a new pool, located in Midway Geyser Basin. Ranger Frank Child passed through the region late in January, and saw nothing unusual. But when he returned during the following week, the pool was there, about forty feet in diameter.

In being born it caused the dislocation of several tons of rock. Some of the dislocated rocks, now thirty feet distant from the pool, are estimated to weigh more than 600 pounds.

The new pool is very hot and very muddy. Violent boiling occasionally takes place on the north side. When this occurs a slight shock can be felt several feet from the edge.

It is located just east of the Black Diamond pool, from which it is separated by a narrow ledge of rock. The Black Diamond is about fourteen inches above the level of the new pool. A small stream of water flows from it to the new pool, and from the latter a stream six times as large in volume is flowing into the river.

Science News Letter, March 3, 1934

PHYSICS

Americans Propose Theory Of Electron and Positron

A THEORY is a mere theory until something that it predicts actually happens. Because Prof. P. A. M. Dirac of Cambridge University, England, evolved a theory of the electron that foretold the existence of the positive electron (positron) which was discovered in cosmic ray crashes by Dr. Carl D. Anderson of Pasadena about 18 months ago, the Dirac formal mathematical symbolism received the intellectual homage of scientists. Incidentally, Prof. Dirac himself shared the Nobel prize for 1933.

Now, two Americans have offered a radically new theory of the electron and positron which goes beyond the Dirac theory and makes more predictions which scientists will proceed to test. Dr. W. H. Furry, a National Research Fellow, and Prof. J. R. Oppenheimer of the University of California present their theory in *Physical Review*, publication of the American Institute of Physics.

One consequence of the Furry-Oppenheimer theory is reminiscent of the famous Heisenberg principle of uncertainty. Roughly, that idea was that it was impossible to know just where a particle was and at the same time know just how fast it was going. The new theory states that the total energy of a system of particles in the presence of an external electro-magnetic field and the total charge and current density of such a system may be determined. But this can be done only at the expense of a precise knowledge of the number of electrons and positrons that are present in the system.

This means that the scientists can not determine with absolute precision the exact spot where cosmic or gamma rays create a pair of electrons. And this is something that scientists have wanted very much to know ever since Dr. Anderson's discovery of positron-electron twins born of cosmic ray smashes into matter.

Due to this necessarily incomplete knowledge, the physicists are forced to conclude that this creation of matter from energy, if such it be, occurs outside the nuclei of atoms. The intense electric fields of the nuclei have little

to do with energy-into-matter conversion, if the theory is correct.

One prediction of the new theory can be submitted to experimental checking. It is that if protons (hydrogen nuclei) are shot through an atmosphere of other protons they will suffer a scattering that differs from that which would be predicted by the old and usually reliable Coulomb law that "force is inversely proportional to the square of the distance between electrically charged particles." If this proves to be the case, the new theory will have gone through its first fire.

Science News Letter, March 3, 1934

BIOLOGY

House Bill Restores Cuts in Research

FOUR IMPORTANT research activities in the Bureau of Biological Survey, which the Budget Bureau had scheduled for annihilation in 1934-35, have been restored in the Agricultural Department Appropriation bill reported to the House.

These are (1) Research on the food habits of birds and animals; (2) Migratory bird investigations; (3) Research on control methods for predatory animals; and (4) Researches on the production of fur-bearing animals.

Restoration of these items in the bill has added a total of \$142,803 for these lines of work.

Science News Letter, March 3, 1934

HISTORY OF SCIENCE

CWA Worker Finds Copy Of "The New World"

A CWA worker, a library helper, has just brought to light an extremely rare and valuable work on America's discovery. It is a book written within twenty years after Columbus' death, printed in beautiful German type and bound in a wood cover shod with tooled leather.

It belongs to the Smithsonian Institution at Washington. Only two other copies are known to exist, and these also