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SUMMARY OF THE RESEARCH PROGRESS MEETING

June 2, 1949

H. P. Kramer

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INFORMATION DIVISION
Radiation Laboratory
Univ. of California
Berkeley, California

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June 2, 1949

H. P. Kramer

Crystal Structure of NaO_2. D. Templeton.

Sodium metal in its oxidation in air at ordinary temperatures represents an anomaly among the halide metals. Sodium burns to Na_2O_2 whereas potassium, cesium, and rubidium form the tetravalent oxide. By burning an excess of K, Cs, and Rb in a limited quantity of oxygen gas it is possible to obtain mixtures of the dioxides and peroxides. It is a surprising fact that the oxide that one would superficially expect to result from the burning of potassium metal, K_2O, is very difficult to prepare and is not very stable. Work that has been done at the University of Kansas in this region of surprises brought forth the compound NaO_2 produced at 500°C and 300 atmospheres. The crystal structure of this oxide differs from that of the corresponding oxides of the other halide metals.

NaO_2 is strongly paramagnetic as one would expect of a substance whose molecules possess one unpaired electron. Since Na_2O_2 is diamagnetic, susceptibility measurements of a mixture form a basis for analysis.

Some of the material was sent here from the University of Kansas for the analysis of the crystal structure by x-ray diffraction. The samples were in powder form and the purest of them were yellow. On exposure to moist air, the substance liberates oxygen gas. It represents an excellent means of storing oxygen in a solid since about 74 percent of its weight is contributed by oxygen.

The results of the x-ray diffraction showed that the crystal is almost a face-centered cube. One may conveniently make an analogy between the structure of NaO_2 and NaCl by imagining that the chlorine atoms in the NaCl lattice are replaced by the elongated (1 x 1.5 Å) oxygen radicals.

Several models have been constructed and the experimental evidence has been compared to values calculated on the basis of the models. The results do not seem to fit very well any of the alternative hypotheses of ordered arrangements and therefore the structure is thought to be a random one.

A calculation was made of the distance between the two oxygen atoms and the resulting value 1.24Å is fairly close to the average of the interatomic distances of O_2 and Na_2O_2, 1.34Å.

Meson Program. H. Bradner.

The apparatus shown in Fig. 1 has been set up inside the cyclotron tank in order to measure the ratio of the number of π^+ to that of π^- mesons. 126 tracks were recently counted on C-2 plates. 74 of these were π-μ decays, 42 were due to μ mesons, and of ten negative tracks, 4 exhibited stars. These results seem to be in agreement with C. Richman's recent work in the deflected proton beam.

An attempt has been made to find complete π^+-μ^+-e^+ decays recorded in the photographic emulsion. 24 π-μ decay tracks were checked but only three of these showed the ultimate decay electron. An example of one of these is sketched in Fig. 2. In conjunction with this work three types of photographic plates were tested to determine which one was best suited for the registering of electron tracks. It was found that of those that were examined, NTB 3 plates were the best. Although the ionization density is only 6 grains/14 microns, only about 15 percent of the grains of a track are attributable to background whereas on the G 5 and NTY plates, one out of 4 grains of a track must be ascribed to background. This background is due to pair production in the emulsion.

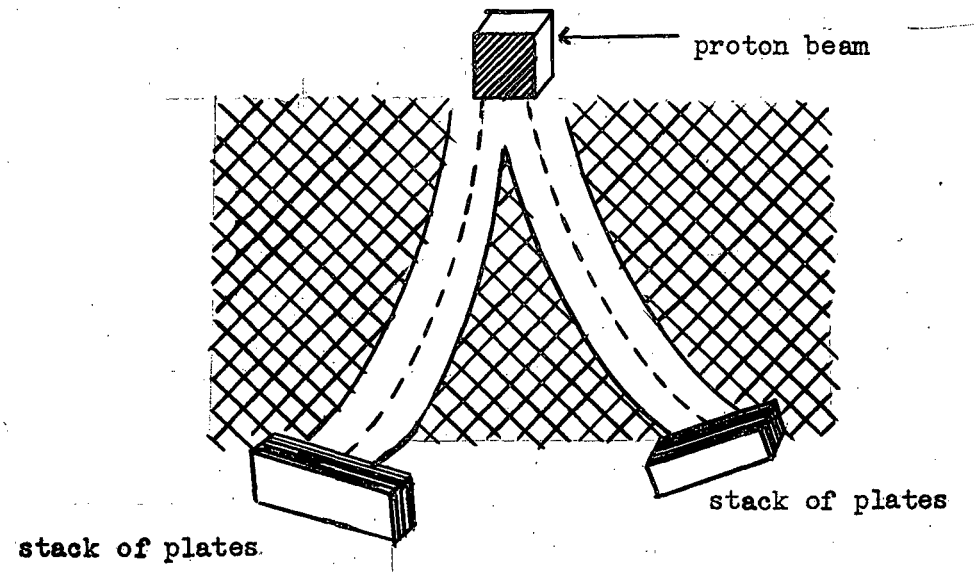

Fig. 1

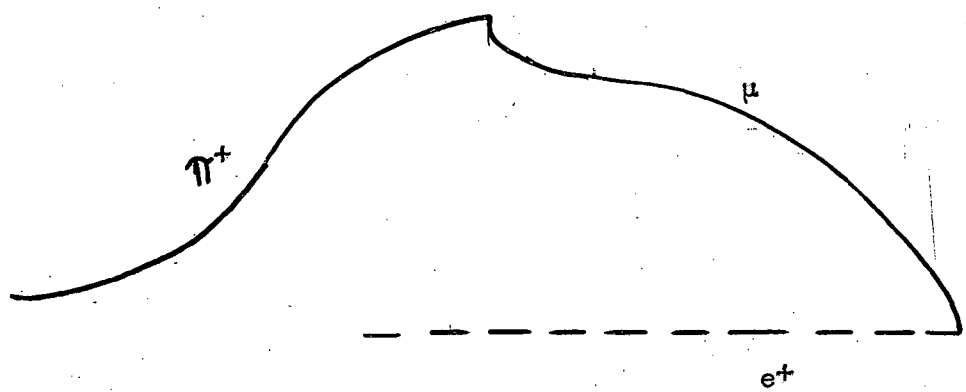

Fig. 2