History

CONVERSATION WITH HALBAN

2-3-44

L. Szilard

On the basis of Hahn's first paper it occurred to Joliot that neutrons may be emitted in the interaction of neutrons with uranium and that this might lead to a chain reaction. He tried to demonstrate this by surrounding a piece of uranium with a radium-beryllium source in the center with a layer of ethyl bromide separate the radioactive bromine by means of the Szilard-Chalmers process and compared the intensity of the bromine activity in the presence and absence of uranium. No conclusive results could be obtained this way and Joliot turned to demonstrate the existence of fission by catching the fission products emitted from a thin layer of uranium oxide which is exposed to a photo neutron source.

In the meantime Halban began to urge Joliot to let him organize more adequate experiments for determining whether neutrons are emitted in fission. Halban used a photo-neutron source of 100 millicurie uranium and measured the thermal neutron density as a function of the radius in a uranium nitrate solution. A primary measurement completed in one day indicated a positive effect (Joliot goes on vacation) and further measurements are carried out during the following week with 300 millicurie confirmed this. A letter was then sent to the editor of Nature.

Subsequent experiments he used photo-neutrons interactive with uranium were shown capable of inducing the n, p reaction in sulphur, in carbon bisulfide.

Second paper by Halban, Joliot, Kovarsky contains a more thorough discussion of the first experiment published in NATURE.

_____ and Halban discuss such things as using a heterogeneous mixture of uranium oxide and water and also other slowing down materials such as carbon and heavy water. In August the experiment later published by Halban, Joliot, Kovarsky and _____ is performed. In September Halban calculates in homogeneous mixtures of water and uranium oxide. In the meantime the war broke out and in October measurements are started on heterogeneous mixtures of water, uranium and oxide. In December an experiment is performed on 8 tons of graphite for the purpose of measuring the absorption of carbon. This leads to a feeling that carbon is only slightly better than water. It is realized that metal is an advantage over uranium oxide because there is no slowing down in the metal due to collisions with oxygen. These carbon lead to shift in the main interest in the direction of heavy water.

Joliot visits Dautry in December or January and finds immediate response. He is tole he made a mistake not to come earlier. The Army wants to get rid of Halban and Kovarsky and Joliot is asked if he could replace them or add some Frenchmen who could gradually learn the subject and displace Halban and Kovarsky. Joliot replies that he hopes gradually to learn the subject himself and that he does not propose to add any other Frenchmen to the group. Dautry gives his full support to Joliot and Joliot has unlimited financial resources at this disposal. It is decided to place a contract through the _____ Bureau (secret service) for the total heavy water output of Norway which is expected to amount to 200 liter per month and negotiations are started at once. Halban and Kovarsky are asked through Joliot whether they would be willing to be interned for three weeks during those negotiations.

Halban accepts on the condition that this be the last foolish demand which is made upon him. Halban is sent to Porquerolles (island military post in south of France) in the middle of February and Kovarsky goes to Belle Isle, Brittany. It is suggested that Joliot himself take a holiday in Grenoble to make Halban and Kovarsky feel better about their confinement. When Halban reports at Porque Rolles showing his order of mission it turns out that Porque Rolles has not been notified of his arrival and of the conditions under which he is to be held there so Halban is for all practical purposes under arrest. A guard is put in front of his door over night who keeps him awake by snoring. Next morning Halban asks to see the commander and informs him that unless the guard is at once replaced by a non-snoring one, he will send a telegram to the minister for armaments and refuse all further collaboration with the French command.

Incidentally, the original order of mission stated that Halban was sent to the island for geological survey and this was done in order to give him freedom of movement on the island;since the commander of the island was not notified directly the order or mission was disregarded. It took one week to reach Dautry who was away from Paris and matters were then straightened out.

160 liters of heavy water arrived in the middle of March. At that time about 6 tons of graphite were on order. Tanks were under construction for the experiment with heavy water. The absorption of sulphur was being measured in order to see if a suspension of uranium in heavy water could be used. An experiment was under preparation to make measurements on a heterogeneous mixture of heavy water and uranium oxide (aluminum cubes were made to be filled with heavy water). The absorption of iron and copper was measured.

On the 14th of May Joliot told Halban that Paris must be considered as lost. This was lightening out of a clear sky for Halban, who had not realized at all the seriousness of the war situation. (1st of April unlimited financial backing) Joliot told Halban that he wanted him to set up a new laboratoryin the south of France, Mont D'Or. A month later Paris fell and Joliot came to the new laboratory . But two days later Dautry's aide appears and asks Halban and Kovarsky to go at once to Bordeaux with all available equipment and materials and all notes and documents. Joliot stays behind but promises he will visit Halban in Bordeaux. At Bordeaux Dautry tells Halban that this work must be saved and that he must go at once to England. He himself and Joliot refused to leave France.

An 8,000 ton coal ship which was put in charge of the Earl of Suffolk and which could take 600 persons stands by and takes all who want to go. Bordeaux is full pf people but only 150 persons can be found who wish to embark. The ship waits three more days for additional passengers but none arrive. Finally as the Germans approach Bordeaux the ship has to leave.

In England there is already a committee under the chairmanship of G. B. Thompson. Halban presents his views to this committee. He talks about the possibility of usirg 93 or 94 in the slow neutron chain reaction. Considers the possibility of a heterogeneous system of uranium and water; believes that carbon beryllium have a chance but chiefly emphasizes the homogeneous uranium heavy water system which he prefers to the heterogeneous heavy water system.

G. B. Thompson does not believe that a chain reaction can be made with unseparated uranium. At that time _____ had already calculated the atomic bomb based on separated 235 and Simon is considering to start work on the separation of 235.