

CZECH CHEMICAL SOCIETY IOANNES MARCUS MARCI SPECTROSCOPIC SOCIETY CZECH TECHNICAL UNIVERSITY IN PRAGUE

17th

Radiochemical

Conference

Artificial Production of a New Kind of Radio-Element
By F. JOLIOT and I. CURIE, Institut du Radium, Paris

SOME months ago we discovered that certain light elements emit positrons under the action of α -particles. Our latest experiments have shown a very striking fact: when an aluminium foil is irradiated on a polonium preparation, the emission of positrons does not cease immediately when the active preparation is removed. The foil remains radioactive and the emission of radiation decays exponentially as for an ordinary radio-element. We observed the same phenomenon with boron and magnesium. The half life period of the activity is 14 min. for boron, 2 min. 30 sec. for magnesium, 3 min. 15 sec. for aluminium.

We have observed no similar effects with hydrogen, lithium, beryllium, carbon, nitrogen, fluorine, sodium, silicon, or phosphorus. Perhaps in some cases the life period is too short for easy observation.

The transmutation of beryllium, magnesium, and aluminium α -particles has given birth to new radio-elements emitting β^+ rays. These radio-elements may be regarded as nuclei formed in a particular way; but it is much more probable that they are known isotopes which have been produced by artificial nuclear reactions.

For example, ^{10}B is transformed into $^{10}\text{B}^+$ by the capture of a neutron, giving a stable ^{11}B being the product. ^{13}N disintegrates with emission of β^+ rays, giving a stable ^{13}C .

nucleus ^{13}C . In the case of aluminium and magnesium, the radioactive nuclei would be ^{24}Al and ^{24}Mg respectively.

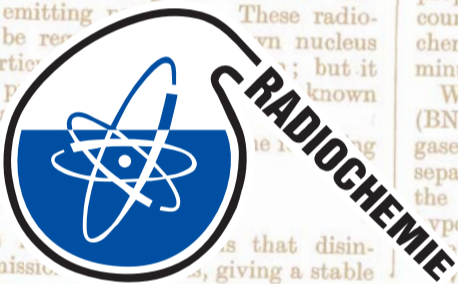
The positrons of aluminium seem to form a continuous spectrum similar to the β rays of the medium energy group (about 3×10^6 e.v.). In the case of the continuous spectrum of β -rays, it will be perhaps necessary to admit the simultaneous emission of a neutrino (or of an antineutrino of Louis de Broglie) in order to satisfy the principle of the conservation of energy and of the conservation of the spin in the transmutation.

The transmutations that give birth to the new radio-elements produced by the bombardment of other transmutations. With a strong polonium preparation of 100 milligrams, one gets only about 100,000 atoms of the radioactive elements. Yet it is possible to determine their chemical properties, detecting their radiation with a counter or an ionisation chamber. Of course, the chemical reactions must be completed in a few minutes, before the activity has disappeared.

We have irradiated the compound boron nitride (BN). By heating boron nitride with caustic soda, gaseous ammonia is produced. The activity separates from the boron and is carried off with the ammonia. This agrees very well with the hypothesis that the radioactive nucleus is in this case an isotope of nitrogen.

When irradiated aluminium is dissolved in

11-16 May 2014, Mariánské Lázně, Czech Republic



RadChem 2014

Organised on behalf of the EuCheMS Division of Nuclear- and Radiochemistry on the occasion of the 80th anniversaries: discovery of the artificial radioactivity by Irène Curie and Frederic Joliot (Nature, Feb. 10, 1934, p.p. 201-202) and Szilard-Chalmers effect discovered by Leo Szilard and T. A. Chalmers (Nature, Sept. 22, 1934, p. 462)

CONFERENCE TOPICS

- Radionuclides in the Environment, Radioecology
- Nuclear Analytical Methods
- Chemistry of Actinide and Trans-actinide Elements
- Radiation Chemistry
- Production and Application of Radionuclides
- Separation Methods, Speciation
- Chemistry of Nuclear Fuel Cycle (organised as the 1st ASGARD International Workshop)
- Radiopharmaceutical Chemistry, Labelled Compounds
- Education

As usually, Equipment and Services Exhibition will be organised in parallel to RadChem 2014.

IMPORTANT DEADLINES

- Call for Abstracts: September 2013
- Abstracts Submission Deadline: 30 November 2013
- Authors Notification: December 2013
- Registration/Hotel Reservation: January/February 2014
- Advance Programme: March/April 2014
- Full Papers: 11 May 2014 (at the on-site registration)

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hydrochloric acid, the activity is carried away by transmutation of the element. The activity can be collected in a tube. The chemical reaction is the formation of phosphine (PH₃) or silicon hydride (SiH₄). The precipitation of the activity with zirconium phosphate in acid solution seems to indicate that the radio-element is an isotope of phosphorus.

These experiments give the first chemical proof of artificial transmutation, and also the proof of the capture of the α -particle in these reactions.

We propose for

These elements and similar ones may possibly be formed by other reactions with other bombarding particles. For example, ^{13}N could perhaps be formed by the capture of a neutron in ^{12}C , followed by the emission of a proton.

Irène Curie and F. Joliot, *J. Phys. et Rad.*, 4, 494; 1933.
 Irène Curie and F. Joliot, *C.R.*, 198; 1934.
 Irène Curie et F. Joliot, *C.R.*, meeting of Feb. 29, 1934.

SIR DONALD MACALISTER, B.A., M.D., F.R.S., died on the 17th of May 1934, at the age of 85. He was born in 1849 and received his school education there and in Aberdeen and Liverpool, the changes in family residence being necessitated by his father's business activities. In 1873 he entered St. John's College, Cambridge, and in 1877 was senior wrangler and first Smith's prizeman in addition to receiving the degree of B.A.

He was, however, not a student of the University of Glasgow and its administration was felt. His exceptionally wide knowledge and culture rendered him highly sympathetic to all the many departments of university studies and activities; this led to his being chosen chairman of the University of Glasgow and its administration was felt. His exceptionally wide knowledge and culture rendered him highly sympathetic to all the many departments of university studies and activities; this led to his being chosen chairman of the University of Glasgow and its administration was felt.

Although deeply interested in scientific and medical research and keenly appreciative of their results, Sir Donald MacAlister was never a 'research man' and one for whom were acquired by the

confidence in the citizens of Glasgow that money was freely forthcoming for the establishment of many new chairs and lectureships and for general university expansion. Nor were the social and athletic sides of student life overlooked. A new Union costing £65,000 was built, new playing fields were provided and three residential halls for men and one for women were acquired by the

Structure of the Ionosphere
The ionosphere is being surveyed by the use of a reversing layer in the times of arrival of the waves. This method is being used to determine the height of the E and F layers. The results show that the E layer is at a height of about 100 km and the F layer is at a height of about 300 km. The ionosphere is being surveyed by the use of a reversing layer in the times of arrival of the waves. This method is being used to determine the height of the E and F layers. The results show that the E layer is at a height of about 100 km and the F layer is at a height of about 300 km.

element, one has to find a new principle of separation. We have attempted to apply the following principle. If we irradiate by a neutron source a chemical element which we are interested in, the atoms are struck by a neutron and become radioactive. Whether the atoms freed in this way are bound in the compound will depend on the compound with which we have to deal. If we work under conditions in which such an interchange does not take place, we obtain the radioactive isotope 'free', and by separating the 'free' element from the compound we can obtain any desirable concentration of the radioactive isotope. We have applied this principle to iodine. Ethyl iodide has been irradiated and a trace of free iodine added to protect the radioactive isotope. By reduction and precipitation as silver iodide in water, it was easy to concentrate the activity so as to get from the precipitate ten times as many impulses of the Geiger-Müller β -ray counter as directly from the irradiated ethyl iodide. Apparently a large fraction of the active substance could be extracted from the ethyl iodide. The quantity of the active element obtainable in the precipitate will naturally depend on the quantity of the compound subjected to irradiation. This principle of isotopic separation has also been applied to some other elements which, like iodine, are common to the organic compounds and further experiments mostly with organic compounds are in progress.

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Sept. 10.
Proc. Roy. Soc., A, 146, 483; 1934.

This case suggests very strongly that the region of the ionosphere is comparable with that of the ionosphere in the case of the group velocity curve. It will be considerably less than its normal value in the space; and this may affect results derived from observations on the intermediate and F layers. In fact, it raised the question as to whether the 'shelves' have a real existence or merely arise as points of inflexion on a group-velocity curve, and this requires further consideration.

J. Inst. Elect. Eng., 72, No. 435, March 1933.

Activated States in the Spectrum of Copper Hydride

In addition to the well-known band system $\Sigma^* \rightarrow \Sigma$ in copper hydride, we recently reported a new band system $\Sigma^{**} \rightarrow \Sigma$, the activated states Σ^* , Σ^{**} forming a doublet ($\nu^* = 23431$, $\nu^{**} = 26369$), corresponding to the spectra of gold hydride. In the spectrum of silver hydride, Σ^* and Σ^{**} have been found, although their presence is indicated by irregularities in Σ^* .

Extending our analysis into the ultra-violet region in the spectrum of copper hydride (in emission), we were able to distinguish two new band systems, Σ^* and Σ^{**} , and forming $\Sigma^* \rightarrow \Sigma$ and $\Sigma^{**} \rightarrow \Sigma$ the Σ^* -terms being given by

Σ^*	Σ^{**}
39	0,018
065	0,066

(loubling coefficient).
 will appear later.
 A. HELMER,
 T. HELMER

A. Helmer and T. Helmer, Z. Phys., 84, 222; 1933.
E. Huthén and R. V. Zumbstein, Phys. Rev., 28, 13; 1926.
E. Bengtsson-Knave, Dissertation, Stockholm, 1932.