THE ARAKATSU AND KIMURA LABORATORIES

Head: Prof. Dr. Kiichi Kimura

In 1938 the Arakatsu-Laboratory was established as the sole section for physical research in the Institute for Chemical Research. Since then under the direction of Professor Bunsaku Arakatsu several researches have been carried out with regard to nuclear physics and its application for other branches of science. It has been also trying to put physics to practical use.

In 1938 Professor Arakatsu installed a high voltage generator of the Cockcroft-Walton type, which has made high activities of this laboratory possible. In 1941 the construction of cyclotron was started by him on a five years' program, and it was nearly completed in november 1945. It was taken away, however, by the Occupation authorities in December of the same year.

In 1950 Professor Kiichi Kimura was appointed head of the laboratory in succession to Professor Arakatsu, who had then retired from his post for his age-limit.

Now in the Kimura Laboratory research is being carried out in the following three subject matters:

I. Nuclear Physics
II. Cosmic Rays
III. Application of Physical Science

Works in these three divisions may be classified and summarized as follows:

I. Nuclear Physics

The research problems are a) Interaction of photon with matter, b) interaction of neutrons with matter, c) other nuclear experiments, and d) radiation detecting instruments.

a) Interaction of Photon with Matter

Interaction of photons with matter is one of the most fundamental problems in physical science. Professor Arakatsu and his co-workers have carried, therefore, on the following research, using high energy gamma-rays: photo-fission of uranium and thorium, photo-neutron and photo-alpha emission from various elements, and gamma-ray absorption by many substances, etc. The main results may be summarized as follows:

1. Determination of the Energy of Photo-Neutrons Liberated from Deuteron by Radium C Gamma-Rays.

By **K. Kimura.**

Mem. Coll. Sci., Kyoto Imp. Univ., A, **22**, 237 (1939).

The binding energy of deuteron was estimated to be 2.189±0.007MeV, which gave the mass of neutron 1.00895 MU. The relative atomic cross-section for photo-disintegration of deuteron against beryllium was 1 : 13.

2. Photo-Fission of Uranium and Thorium Produced by the Gamma-rays of Lithium and Fluorine Bombarded with High Speed Protons.

By **B. Arakatsu, Y. Uemura, M. Sonoda, S. Simizu, K. Kimura** and **K. Muraoka.**

Proc. Phys.-Math. Soc., Japan, **23**, 440 (1941).

The photo-fission phenomenon of uranium and thorium under the irradiation of 17 MeV gamma-rays of Li(p, γ) reaction was ascertained. The fission cross-sections of uranium and thorium nuclei for these gamma-rays were found to be ;

$\sigma_{u(17)} = 16.7 \times 10^{-27}\text{cm}^2$ for Li (p, γ) γ-rays

$\sigma_{Th(17)} = 7.2 \times 10^{-27}\text{cm}^2$ for Li (p, γ) γ-rays

$\sigma_{u(6\cdot3)} = 2.2 \times 10^{-27}\text{cm}^2$ for F (p, γ) γ-rays

and $\sigma_{u(2.2)} = 0.005 \times 10^{-27}\text{cm}^2$ for RaC γ-rays.

3. The Range of the Photo-Fission-Fragments of Uranium Produced by the Gamma-Rays of Lithium Bombarded with Protons.

By **B. Arakatsu, M. Sonoda, Y. Uemura** and **S. Shimizu.**

Ibid., **23**, 633 (1941).

The maxium range of photo-fission-fragments of uranium produced by the 17 MeV gamma-rays was measured to be $R_{max} = 1.30$cm in the air. From this result as well as from theoretical consideration, it was found that the liberated energy of the photo-fission process of uranium is to be smaller than that expected from the case of neutron-fission.

4. A Type of Nuclear Photo-Disintegration: The Expulsion of Alpha-Particles from Various Substances Irradiated by the Gamma-Rays of Lithium and Fluorine Bombarded with High Speed Protons.

By **B. Arakatsu, M. Sonoda, Y. Uemura, S. Shimizu** and **K. Kimura.**

Ibid., **25**, 173, (1943).

It was ascertained that alpha-particles were ejected generally from various substances by the irradiation of 17 MeV gamma-rays, but weaker effect was also observed by 6.3 MeV gamma-rays. It was concluded that the atomic nucleus is generally induced to be a state of alpha-transformation nucleus under the radiation field of very high frequency.

The above phenomenon was also ascertained by cloud chamber observation. (see the next).

5. Cloud Chamber Observation of Photo-Alpha Particles Produced by 17 Mev Gramma-Rays.

By **B. Arakatsu, S. Shimizu, T. Hanatani** and **J. Muto.**

Journ. Phys. Soc., Japan, **1**, 24 (1946).

6. Nuclear Reaction Cu^{63} (γ, n) Cu^{62} Produced by 17.6 Mev Gamma-Rays.

By **S. Shimizu, Y. Uemura, R. Ishiwari, Y. Saji** and **J. Muto.**

Rep. Inst. Chem. Res., Kyoto Univ., **19**, 23, (1949) (in Japanese).

7. Photo-Induced Reaction Cu^{63} (γ, n) Cu^{62} Produced by the Gamma-Rays of Lithium Bombarded with High Speed Protons.

By **S. Shimizu.**

Mem. Coll. Sci., Univ. of Kyoto, A. **25**, 193, (1949).

The cross-section of Cu^{63} $(\gamma,n)Cu^{62}$ reaction produced by 17.6 MeV gamma-rays was found to be $\sigma=9.6\times10^{-26}cm^2\pm20\%$.

8. On the Photo-Disintegration of Beryllium by the High Energy γ-Rays.

By **B. Arakatsu, M. Sonoda, Y. Uemura, S. Yasumi** and **Y. Saji**

Ibid., **23**. 97 (1950); Bull. Inst. Chem. Res., Kyoto Univ., **22**, 71 (1950); Journ. Phys. Soc. **6**, 66 (1950).

The photodisintegration of Be by the γ-rays of 17.6 and 6.13 MeV was observed by means of the proportional counter of a methane flow type. The pulse of α-particles were observed on the screen of braun tube. From the analysis of the results obtained the following disintegration schema were concluded:

1) $Be^9+17.6Mev\gamma\rightarrow Be^{8*}+n$ $Be^{8*}\rightarrow 2\alpha$ Be^{8*} in 7 Mev excited state.
2) $Be^9+17.6Mev\gamma\rightarrow Be^8+n$ $Be^8\rightarrow 2\alpha$ Be^8 in ground state.
3) $Be^9+6.13Mev\gamma\rightarrow Be^8+n$ $Be^8\rightarrow 2\alpha$

The cross-sections for these three processes were found to be

1) $2.15\times10^{-27}cm^2$
2) $5.1\times10^{-26}cm^2$
3) $1.62\times10^{-27}cm^2$

respectively.

The trend of the excitation curve is entirely different from the theory of E. Guth. Moreover, it seems noticeable that the excited states of Be^{8*} of energy 3.0 Mev and 4.8Mev do not contribute in these processes.

9. The (γ, n) Reaction of Molybdenum Produced by the Li $(p.\gamma)$-γ-Rays.

By **S. Shimizu, S. Yasumi, Y. Saji** and **J. Muto.**

Mem. Coll. Sci., Univ. of Kyoto, A. **26**, 85 (1950).

The (γ, n) reaction of molybdenum produced by the irradiation of Li $(p, \gamma)\gamma$-rays was observed. The radioactivities induced in molybdenum samples were measured precisely by an end-window type β-ray counter with a thin mica window. By measuring the intensities of activities produced in a set of molybdenum samples of various thickness and the number of γ-ray quanta concerned, the apparent cross section of this reaction for the sample with different thickness was observed. And the absolute cross section of the Mo^{92} (γ, n) Mo^{91} reaction for the Li$(p, \gamma)\gamma$-rays

was determined as $9.9\times10^{-26}cm^2$. Some discussions on the results obtained are also given.

10. Measurement of Absorption Coefficients of 17 Mev and 6.1 Mev Gamma-rays in Several Elements.

By **Y. Uemura.**

Bull. Inst. Chem. Res., Kyoto Univ., **22**, 18 (1950).

The γ-ray absorption coefficients of Pb, Sn, Cu, and Al were measured for the 17.6 Mev and 6.1 Mev γ-rays produced at the first proton resonance of the (Li-p) and (F-p) reactions respectively.

The absorption coefficients obtained are given as follows:

γ-ray source	Pb_{82}	Sn_{50}	Cu_{29}	Al_{13}
(Li-p) γ-ray	0.58±0.02	0.34±0.01	0.28±0.01	0.062±0.007
(F-p) γ-ray	0.50±0.01	0.23±0.01	0.27±0.01	—

Analysing these experimental data, the absorption due to the creation of electron pairs seems to be proportional to Z^2 in the case of the 17.6Mev γ-rays. However, it is to be noted that the absorption coefficient of Al for the 17.6 Mev γ-rays is found to be larger than the theoretical value.

11. A Note on the Angular Distribution of Pair-Electrons of 17 Mev Gamma-Rays.

By **S. Shimizu** and **J. Muto**

Mem. Coll. Sci., Univ. of Kyoto, A. **25**, 61 (**1949**).

12. Measurement of the Absorption Coefficient of Co^{60} γ-Rays by Various Metalic Elements.

By **S. Shimizu, S. Okamoto** and **T. Hanai.**

Bull. Inst. Chem. Res., Kyoto Univ., **25**, 53 (1951).

The absorption coefficient (cm^{-1}) observed are:

$_{12}Mg,0.099_4$; $_{13}Al,0.14_3$; $_{26}Fe,0.40_8$; $_{28}Ni,0.48_8$; $_{29}Cu,0.46_4$. $_{30}Zn,0.36_6$; $_{48}Cd,0.43_8$; $_{50}Sn,0.36_2$; $_{51}Sb,0.33_4$; $_{80}Hg,0.74_9$; $_{82}Pb,0.64_3$; $_{83}Bi,0.56_6$.

13. On the Spectrum of Co^{60}-γ Rays.

By **T. Azuma, K. Tsumori** and **K. Kimura.**

Journ. Phys. Soc. Japan (in press).

14. On the Gamma-Rays of K^{40}.

By K. Kimura, T. Hayashi, Y. Ishizaki and **K. Nishikawa.**

Bull. Inst. Chem. Res., Kyoto Univ., **21**, 55 (1950).

To make clear the disintegration schema of K^{40}, it is important to know the relation between its β- and γ-rays. So this relation was measured with a coincidence counters which were specially devised to eliminate the natural background as

completely as possible.

The actual counts of coincidence observed are as follows:

natural counts 33/10h

Sample+natural 31/10h

From these results it seems more reasonable to think that the β-γ coincidence does not exist.

b) Interaction of Neutrons with Matter

On this subject, the following research have been carried out: the fission cross section of uranium by thermal neutrons, the emission of the delayed neutrons accompanying with uranium fission and the disintegration of N^{14} by thermal neutrons, etc.

1. Liberation of Fast Neutrons in the Nuclear Explosion of Uranium Irradiated by Thermal Neutrons.

By **T. Hagiwara.**

Mem. Coll. Sci., Kyoto Imp. Univ., A, **23**, 19 (1940)

The average number of neutrons liberated per fission of uranium by thermal neutrons was found to be 2.6.

2. Measurement of the Capture Cross Section of Uranium Nuclei for Thermal Neutron.

By ***B. Arakatsu, T. Hanatani*** and ***K. Kimura.***

Unpublished (June, 1945).

3. Fission Cross Section and Absorption Cross Section of Uranium Nuclei for Thermal Neutron.

By **B. Arakatsu** and **T. Hanatani.**

Unpublished (June, 1945).

The fission cross section of uranium by thermal neutrons was estimated to be 2.9 ± 0.2. The possibility of chain reaction of uranium was also ascertained.

4. On the Disintegration of $_7N^{14}$ by Slow Neutrons: Accurate Determination of the Energy of Reaction.

By **R. Ishiwari** and **K. Yausa.**

Rep. Inst. Chem. Res., Kyoto Univ., **19** 19, (in Japanese) (1949).

5. The Energy Released in the Disintegration of Nitrogen by Thermal Neutrons.

By **R. Ishiwari** and **K. Yuasa.**

Mem. Coll. Sci, Univ. of Kyoto, A, **26**, 151 (1950).

The energy released in the $_7N^{14}(n,p)_6C^{14}$ reaction produced by thermal neutrons has been determined by the parallel plates ionization chamber with linear amplifier filled with atmospheric air dried by $CaCl_2$. For the eneagy calibration, alpha-particles from ThC′ were used as standard, and the correction for the systematic error

introduced by the calibration was made by the aid of the theoretical analysis of the pulse shape in the linear amplifier. By assuming the proportionality between the amount of the total ionization in air and the energy of the particle, we have obtained the Q-value of the reaction as 0.609±0.005Mev. Taking the end point energy of the beta-spectrum of $_6C^{14}$ as 0.156±0.001Mev, the neutoon-hydrogen mass difference has been determined as 0.765±0.005Mev.

6. On the Nuclear Reaction of $_7N^{14}$ by Thermal Neutrons.

By **K. Kimura, R. Ishiwari, K. Yuasa, S. Yamashita, K. Miyake and S. Kimura.**

Bull. Inst Chem. Res., Kyoto Univ. (in press).

7. Observation of the B(n, α)Li Reactions with the Wilson Cloud Chamber.

By **M. Sonoda, J. Muto** and **S. Yasumi.**

Bull. Inst. Chem. Res., Kyoto Univ., **21**, 57 (1950).

B(n,α)Li reaction was studied with the cloud chamber. The tracks of α-particles stereoscopically photographed were investigated by the "reproduction method", and 30 short tracks probably assignable to the $B^{10}(n,\alpha)Li^7$ reaction were observed. But the tracks due to the disintegration of the Li^8 nucleus were not obtained.

c) Other Nuclear Experiments

Some fundamental measurements regarding nuclear physics have been carried out. The results obtained are listed in the following :

1. On the Range-Energy Relation of α-Particles in the Air.

By **K. Kimura, R. Ishiwari, K. Yuasa, S. Yamashita, H. Miyake** and **S. Kimura**

Bull. Inst. Chem. Res., Kyoto Univ. (in press).

The range-energy curve for α-particle in the air established by Holloway and Livingston was revised by Bethe and Jesse et. al. to fit in with the fixed points in low energy region obtained from nuclear reactions. In this revision, the source of error contained in Holloway-Livingston curve was attributed to the deviation from proportionality of the ionization-energy relation for α-particle in the air, which was regarded as an essential property of the air.

In the present study, we examined the specific ionization curve for α-particle in the air with almost the same experimental arrangement as Holloway-Livingston's experiments, and obtained the results which claim that the error contained in their curve is to be attributed to the columnar recombination rather than the essential deviation of the ionization-energy relation in the air.

2. A Method of Measuring Ion Mobility Using an Alpha-Ray Counter.

By **K. Yuasa** and **R. Ishiwari.**

Ibid., **21**, 61 (1950).

As an application of the analysis of the pulse shape of alpha-ray counter, a

method of measuring ion-mobility of gas filled in an ionization chamber was devised.

By this method the relation of the mobility to the age of ions and the effect of humidity were investigated in the air. With the air dried by $CaCl_2$, we obtained,

$$k_- = 2.2$$

$$k_+ = 1.7 \quad : \text{age} > 1 \times 10^{-3}\text{sec}$$

$$2.2 \quad : \text{age} < 2.5 \times 10^{-4}\text{sec}$$

In the interval from 2.5×10^{-4}sec to 1×10^{-3}sec, fast and slow ions mixed together. As for the effect of humidity, our results were in good agreement with those of Tyndall and Grindly.

3. Some experiments on P^{32}.

By **S. Shimizu, Y. Uemura, R. Ishiwari, O. Horibe.** and **S. Okamoto.**
Ibid., 22, 72 (1950).

4. On the Extraction and Yield of P^{32} from CS_2 by the Bombardment of Fast Neutrons.

By **M. Ishibashi, K. Kimura, S. Shimizu** and **Y. Kusaka.**
Ibid., (in press).

The radioactive P^{32} was prepared through the irradiation of CS_2 by fast neutrons from 50mg Ra+Be source. In separating P^{32} from CS_2 no carrier phosphate was used. In this case the yield of P^{32} increased to about 0.4μC per month.

5. Positive Charged Particles Accompanying with P^{32} β-Decay.

By **T. Yanabu, J. Muto** and **H. Nishimura.**
Ibid., (in press).

6. Back Scattering of β-Rays of C^{14} and P^{32}.

By **S. Shimizu, M, Nakamura** and **I. Kumabe.**
Ibid., (in press).

7. Study on the Radioactivity of Hokutolite in Taiwan by Means of a Counter with the Linear Amplifier.

By **K. Kimura.**
Mem. Coll. Sci., Kyoto Imp. Univ., A, **23**, 7 (1940).

The α-radioactivity of Hokutolite of Formosa was observed. The apparatus used was a counter of the parallel plate condensor type connected with the linear amplifier, which made it possible to detect the individual α-particle in the presence of β- or γ-rays. As the natural background of this counter is one or two per hour, accurate measurements may be carried out for feeble α-emitter like igneous rocks. In this work a number of interesting results were observed. Above all, it was found that the α-activity of the natural surface of Hokutolite is mainly due to polonium and that of the inside to radium, its products being in equilibrium. The content of polonium was estimated fifteen times as much as that of the derivatives of radium.

8. **Measurement of the Radioactivity of Sedimentation Products of the Ikeda Mineral Spring.**

By **K. Kimura, R. Ishiwari, T. Hayashi** and **K. Nishikawa.**

Rep. Inst. Chem. Res., Kyoto Univ., **17**, 89 (1949).

The authors measured the radioactivity of sediment of the Ikeda Mineral Spring with a β-counter of the Geiger-Müller type and α-counter of the Wynn-Williams type. The contents of RaTh and Ra in one gram of sediment were estimated to be 4.3×10^{-13} gr/gr and 5.7×10^{-11} gr/gr, respectively.

9. **Half-Life of ThC′.**

By **K. Kimura, T. Hayashi, Y. Ishizaki, I. Kumabe** and **F. Fukuzawa.**

Bull. Inst. Chem. Res., Kyoto Univ., (in press).

The half-life of ThC′ was measured by a delayed coincidence counter to the order of 10^{-7}sec.

d) Radiation Detecting Instruments

Various types of radiation detecting instruments and recordors were constructed, and studies in the characteristics of these were carried out. These instruments and measuring techniques have been used both in nuclear research as well as in tracer experiments with radioisotypes. The results obtained are listed in the following:

1. **Counting Instrument with Linear Amplifier.**

By **K. Kimura** and **Y. Uemura.**

Mem. Coll., Sci., Kyoto Imp. Univ., A, **23**. 1 (1940).

2. **Study on Pulse Shapes of Alpha-Ray Counter with Ionization Chamber and Linear Amplifier.**

By **Y. Uemura. R. Ishiwari** and **K. Yuasa.**

Bull. Inst. Chem. Res., Kyoto Univ., **21**, 60, (1950).

3. **On the Characteristics of Ionization Chamber with Screen-Grid. (I).**

By **K. Kimura, K. Yuasa, S. Yamashita** and **R. Ishiwari.**

Bull. Inst. Chem. Res., **23**, 54 (1950).

4. **A Decade Scaling Circuit.**

By **R. Ishiwari** and **K. Yuasa.**

Mem. Coll. Sci., Univ. of Kyoto, A, **25**, 155 (1949).

5. **On the Proportional Counter.**

By **M. Sonoda.**

Mem. Coll. Sci., Univ. of Kyoto, A, **25**, 185 (1949).

6. **On the Property of the Proportional Counter.**

By **M. Sonoda.**

Bull. Inst. Chem. Res., Kyoto Univ., **21**, 58 (1950).

7. Flow-Type Beta-Ray Proportional Counter.

By **M. Sonoda.**

Saishin-Igaku, **5**, 748 (1950) (in Japanese); Bull. Inst. Chem. Res., Kyoto Univ., **24**, 63 (1951).

8. A Type of Geiger-Muller Counter Suitable for the Measurement of High Energy Gamma-Rays.

By **M. Sonoda.**

Mem. Coll. Sci., Univ. of Kyoto, A, **25**, 175 (1949).

9. On the Eliminating Method of Natural Counts of G-M Counter.

By **K. Kimura, T. Hayashi, K. Nishikawa** and **Y. Ishizaki.**

Rep. Inst. Chem. Res., Kyoto Univ., **18**, 86 (1949) (in Japanese).

10. An Attempt to Eliminate the Natural Counts of the G-M Counter.

By **K. Kimura, T. Hayashi, Y. Ishizaki** and **K. Nishikawa.**

Ibid., **21**, 54 (1950).

11. Portable Radiation Detector Instrument.

By **S. Shimizu** and **O. Horibe.**

Bull. Inst. Chem. Res., Kyoto Univ., **20**, 43 (1950).

12. Absolute Measurement of Beta-Rays by 2π-Type Counter.

By **Y. Saji.**

Saishin-Igaku, **5**, 744 (1950) (in Japanese).

13. The Efficiency of the G-M Counter for High Energy Gamma-Quanta.

By **M. Sonoda.**

Bull. Inst. Chem. Res., Kyoto Univ., **21**, 58 (1950); **22**, 70 (1950); Journ. Phys. Soc. **5**, 403 (1950); **5**, 53, (1950); **5**, 408 (1950).

14. On the Properties of 2π-Type Beta-Ray G-M Counter. (I).

By **Y. Uemura, S. Shimizu** and **Y. Saji.**

Ibid., **21**, 56 (1950).

15. On a Stable 2π-Type Beta-Ray Counter.

By **S. Shimizu, Y. Uemura** and **Y. Saji.**

Ibid., **21**, 57 (1950).

16. On Some properties of 2π-Type Counter. (II).

By **Y. Uemura, Y. Saji** and **S. Shimizu.**

Ibid., **23**, 56 (1950).

17. On Some Properties of the 2π-Counter (III).

By **S. Shimizu, Y. Uemura** and **Y. Saji.**

Ibid., (in press).

18. On the Delayed Coincidence Circuit. (I).

By **K. Kimura. T. Hayashi, Y. Ishizaki** and **K. Nishikawa.**

Ibid., 23, 51 (1950).

19. On the Delayed Coincidence Circuit. (II).

By **K. Kimura, T. Hayashi, Y. Ishizaki** and **F. Fukuzawa.**

Ibid., 23, 51 (1950).

20. A Study on the Mechanism of G-M Counter.

By **K. Kimura, K. Nishikawa, T. Hayashi** and **Y. Ishizaki.**

Ibid. (in press).

21. A Trial Manufacture of a Counting Rate Meter.

By **T. Yoshida** and **T. Yanabu.**

Ibid., (in press).

22. A Design of the High Speed Counting Circuit.

By **S. Shimizu** and **S. Okamoto.**

Ibid., (in press).

23. Operation of an Electron-Multiplier.

By **S. Shimizu, H. Takekoshi, H. Nishimura** and **N. Ogura.**

Bull. Inst. Chem. Res., Kyoto Univ., **23**, 53 (1950).

24. On a Scintillation Counter.

By **S. Shimizu, H. Takegoshi** and **H. Nishimhra.**

Ibid., (in press).

25. On the Secondary Electron Multiplier.

By **H. Takekoshi, S. Shimizu** and **H. Nishimura.**

Ibid., (in press).

26. On the Measurement of the Radiation Energy by Means of the Scintillation Counter.

By **S. Shimizu, H. Takekoshi, O. Tsuruoka** and **H. Nishimura.**

Ibid., (in press).

II. Cosmic Rays

Professor Kimura and his co-workers observed cosmic rays with photographic plates (NTB ····· manufactured by the Eastman Kodak Company). These were exposed to cosmic rays on Mt. Norikura (2840m above the sea level). The developed plates were scanned with a constant speed by microscope. The distribution of the number of stars about the number of prongs, the variation of the number of stars with altitude, and masses of single tracks were determined. The results published are as follows :

1. Observation of Cosmic-Rays with photographic Emulsions. (1).

By **K. Kimura, S. Tokunaga, K. Yuasa** and **R. Ishiwari.**

Bull. Inst. Chem. Res., Kyoto Univ., **21**. 59 (1950).

2. Observation of Cosmic Rays with Nuclear Emulsions.

By **K. Kimura, S. Tokunaga, R. Ishiwari** and **K. Yuasa.**
Mem. Coll. Sci., Univ. of Kyoto, A. **26**. 167 (1950).

3. Observation of Cosmic Rays with Photographic Emulsion (II).

By **K. Kimura, K. Yuasa, R. Ishiwari** and **S. Tokunaga.**
Bull. Inst. Chem. Res., Kyoto Univ., **22**, 70 (1950).

III. Application of Physical Science

In this division the following problems have been adopted.

a) high speed Rotation
b) Photo-Elasticity
c) Plastic Substance
d) Semi-Conductor
e) High Vacuum Technique
e) Miscellaneous

a) High Speed Rotation

A small rod magnetically suspended in the vacuum was driven by a rotating magnetic field of high frequency. The maxium speed of rotation obtained was 28,600 r. p. s. for a rod of 0.298cm in diameter and 1.5cm in length. The acceleration of centrifugal force at perifery was about 4.93 million times as much as gravity and the periferal speed was 269m/sec.

1. On the magnetic Suspension Mechanism for Research of High Speed Rotation.

By **B. Arakatsu, A. Katase, J. Kokame** and **S. Yano.**
Rep. Inst. Chem. Res., Kyoto Univ., **17**, 87 (1949) (in Japanese).

2. High Speed Rotation with the Rotor Suspended by "Magnetic Bearing".

By **B. Arakatsu, A. Katase, J. Kokame** and **S. Yano.**
Oyo-Butsuri, **18**, 35 (1949) (in Japanese).

3. A Study on High Speed Rotation. (II).

By **B. Arakatsu, A. Katase, J. Kokame** and **S. Yano.**
Rep. Inst. Chem. Res., Kyoto Univ., **18**, 92 (1949) (in Japanese).

4. Study on High Speed Rotation. (III).

By **B. Arakatsu, A. Katase, J. Kokame** and **S. Yano.**
Ibid.; **19**, 31 (1949) (in Japanese).

5. A Study on High Speed Rotation. (IV).

By **B. Arakatsu, A. Katase, J. Kokame** and **S. Yano.**
Bull. Inst. Chem. Res., Kyoto Univ., **21**, 60 (1950) (in Japanese)

6. A Study on High Spee Rotation. (V).

By **B. Arakatsu, A. Katase, J. Kokame** and **S. Yano.**
Ibid., **22**, 67 (1950).

7. On the Whirling of the Rotating Shaft at High Rotational Speed.

By **J. Kokame, A. Katase** and **S. Yano.**
Ibid., 22, 68 (1950).

8. On the Torque Acting on the Rotor Rotating in the Rotating Magnetic Field.

By **S. Yano, A. Katase** and **J. Kokame.**
Ibid., 22, 69 (1950).

9. Self-Damping Oscillation of Magnetic Suspension Mechanism.

By **J. Kokame, A. Katase** and **M. Nawachi.**
Ibid., (in press).

b) Photo-Elasticity

Several applications of photo-elasticity have been carried out for practical use as shown in the following list.

10. Measurement of the Coefficient of Friction by Photo-Elastic Method.

By **Y. Uemura.**
Rep. Inst. Chem. Res., Kyoto Univ., **16**, 53 (1947).

11. Preparation of a Test-Piece of Gelatin-Jelly for Photo-Elasticity.

By **Y. Uemura.**
Ibid., **17**, 93 (1949) (in Japanese).

12. A Study on the Plastic Deformation from the Drawing Mechanism by Means of Photo-Elasticity.

By **Y. Uemura.**
Ibid., **18**, 88 (1949) (in Japansee).

13. Measurement of the Coefficient of Friction by Maans of Photo-Elasticity.

By **Y. Uemura, M. Takai** and **K. Takemura.**
Bull. Inst. Chem. Res., Kyoto Univ., **23**, 52 (1950).

c) Plastic Substance

Physical properties of clay was studied to select clay suitable for making china wares and pencils of high quality.

14. On the Electric Loss of the Low Fired (below 1000°C) Clay under High Frequency.

By **K. Fujii** and **S. Terai.**
Rep. Inst. Chem. Res., Kyoto Univ., **17** 91 (1949).

15. Studies in Clay. (I).

By **B. Arakatsu** and **T. Shidei.**
Ibid., **19**, 28 (1949) (in Japanese).

16. A Study on the Extrusion Press using Clay.

By **K. Kimura, Y. Uemura** and **T. Yanabu.**
Ibid., **18**, 81 (1949) (in Japanese).

17. Studies in Clay. (II).

By **T. Yanabu, T. Yoshida** and **Y. Uemura.**
Ibid., **19**, 29 (1949) (in Japanese).

18. On the Relation between the Coefficient of Friction and "Writing Ease" of the Pencil.

By **Y. Uemura** and **T. Yanabu.**
Ibid., **18**, 84 (1949) (in Japanese).

19. On the Extrusion Press. (in Japanese).
On the Physical Properties of the Pencil. (in Japanese).
On the Clay Suitable for Making Pencils. (in Japanese).

By **Y. Uemura** and **T. Yanabu.**
First Report of the Commitee for Pencils, Osaka Pref., Aug., (1949). 3-44.

20. The Dielectric Properties of Mud-Pastes under the Alternating Field of Low Frequency.

By **K. Kimura, Y. Uemura, T. Yanabu** and **T. Yoshida.**
Bull. Inst. Chem. Res., Kyoto Univ., **23**, 58 (1950).

d) The Semi-Conductor

Studies in the semi-conductor are the most interesting problem today in physics and for practical use. So in the Kimura laboratory some experiments were done as seen in the following list.

21. Electron Bombardment Conductivity of BaO+SrO.

By **K. Kimura** and **K. Ohira.**
Bull. Inst. Chem. Res., Kyoto Univ., **20**, 41 (1950).

22. Researches on the Activation Energy of (Ba, Sr)O by Electron Bombardment.

By **K. Ohira.**
Mem. Coll. Sci., Univ. of Kyoto, A, **26**, 131 (1950).

23. Electron Bombardment Conductivity of (Ba, Sr)O (II).

By **K. Kimura** and **K. Ohira.**
Bull. Inst. Chem. Res., Kyoto Univ., **23**, 53 (1950).

e) High Vacuum Technique

For the purpose of nuclear experiments high vacuum technique is required,

Therefore, the measurements of high vacuum and pumping speed have been carried out. Pumps of high speed were designed and manufactured. The leading works done are listed below :

24. On a Device of the Gas Leak Apparatus for Measuring pumping Speed.

By **Y. Uemura, M. Sakisaka** and **S. Miyashiro.**
Bull. Inst. Chem. Res., Kyoto Univ., **23**, 58 (1950).

25. On the Characteristics of a Phillips Gauge.

By **Y. Uemura, M. Sakisaka** and **S. Miyashiro.**
Ibid., (in press).

26. Pumping Characteristics of a Large Size Vacuum Pump.

By **Y. Uemura, M. Sakisaka** and **S. Miyashiro.**
Ibid., (in press).

27. The Ratio of Pumping Speed of H_2 to D_2 in the Oil Diffusion Pump.

By **Y. Uemura. M. Sakisaka, Y. Ōno** and **S. Miyashiro.**
Ibid., (in press).

28. A New Method for Leak-Detecting.

By **K. Kimura, M. Sakisaka** and **S. Miyashiro.**
Ibid., (in press).

29. Studies in Oil Diffussion Pump with a Diverging Nozzle.

By **Y. Uemura, T. Yanabu** and **Y. Ōno.**
Ibid., (in press).

f) Miscellaneous

The chief works not included in the above are shown in the following list.

30. A Study on the Ion Source.

By **B. Arakatsu, Y. Uemura, S. Yasumi, M. Sakisaka** and **S. Miyashiro.**
Ibid., (in press).

31. Studies in the Ion Source Placed in a Magnetic Field.

By **M. Sakisaka, S. Miyashiro, Y. Uemura** and **S. Yasumi.**
Mem. Coll. Sci., Univ. of Kyoto, A, **26**, 143 (1950).

32. The Deep-Drawing Process.

By **Y. Uemura, S. Koyabu, S. Ono** and **S. Kawamoto.**
A General View on the Technique of Iron and Steel of Japan. (1950) (in Japanese).

33. On the Stability of the Tube Potentiometer.

By **T. Yoshida, T. Yanabu, Y. Uemura** and **K. Kimura.**
Bull Inst. Chem. Res., Kyoto Univ., **21**, 54 (1950).

34. E_p-I_p Characteristic Curves of Magnetron.

By **K. Kimura, I. Kumabe, I. Nakato, H. Ueyanagi** and **A. Kusumegi.**
Ibid., **23**, 55 (1950).

35. Trial Manufacture of an Electron Accelerator Using a Cavity Resonator.

By **K. Kimura, I. Kumabe, I. Nakato, H. Ueyanagi** and **A. Kusumegi.**
Ibid., **23**, 56 (1950).

36. Automatic Diameter Selection of Pins (Part of Roller Chains).

By **K. Kimura, Y. Uemura** and **S. Yamashita.**
Rep. Inst. Chem. Res., Kyoto Univ., **19**, 32 (1949).

An auto-selecting machine was invented. The machine classifies pins, balls or plates into several groups of size. The selecting speed is 100 per minute in the accuracy of 0.01mm.