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KUNIHIKO KODAIRA AS I HAVE SEEN HIM*

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For those who are interested in the life and works of Kunihiko Kodaira (1915-1997), it is fortunate that he has left his autobiography [1] as well as his Collected Works [2]. The latter is provided with an excellent preface by Professor W. L.. Baily, Jr. at the University of Chicago, one of Kodaira's students at Princeton University in the early 1950's, giving a thorough and careful explanation of its contents. Kodaira has left, moreover, a large number of publications in Japanese, including many text-books in various fields of mathematics and also essays on non-mathematical subjects, the latter of which were gathered in his book [3]. Thus we have an abundance of first hand material on him.

As I shall recount in the following lines, I made his acquaintance in 1935 and shared the life on this earth for more than 60 years since then in a relatively close relationship with him. I should be happy, if this article based largely on the above material, including, however, some of my personal reminiscences on him could interest the reader of this journal.

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Let me permit myself to begin this article by speaking for a while of my own career. I studied in the Department of Mathematics of Tokyo University for 1926-29 in the undergraduate course, then one and half more years in the graduate course under the guidance of Professor Teiji Takagi, founder of the class field theory in which I could begin some research works. In 1931 I left Japan to study further in Europe. First I went to Hamburg to study with Artin, who had got an important result to complete the class field theory. I was very fortunate to make there the acquaintance of Claude Chevalley who had come from Paris just for the same period. In 1932, I participated in the International Congress of Mathematicians at Zurich where I was happy to again see Professor Takagi, invited there as one of the vice-presidents together with such mathematicians as Hilbert and Hadamard. I stayed two more years in Europe, principally in Paris, where I had a chance to meet Henri Cartan, André Weil, Jean Dieudonné and others, who began the well known work of innovation of entire mathematics under the collective pseudonym of Bourbaki (since 1936, after my return to Japan.) I could learn from them, among other things, the "unity of mathematics," i.e. that the entire mathematics has a common ground inspite of its different branches; arithmetic, algebra, geometry, analysis etc. I returned to Tokyo in 1934 and in the following year, I was admitted as teaching staff (associate professor) of Tokyo Univesity. Incidentally, Professor Takagi attained the retirement age of 60 years in 1935 and he was to give his last lectures at this Department in 1935-36. The subject of these lectures was an Introduction to Analysis for the first year students (the infinitesimal calculus plus the beginning of the complex analysis of elementary functions) and I had the honor of being charged with doing the exercises of these

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It happened that Kodaira entered this Department in this year 1935 and I met him in a class room just a few weeks later in an hour of doing exercises. I remember that I had given as an exercise problem to prove that the base e of the natural exponential function is not an irrational of the second degree (after it had been proved in a lecture that e is irrational.) Kodaira came to the black-board and wrote his proof in a few lines without speaking any word. In reading these lines with other students, we admired his perfect proof, where every word was to the point! I heard later that his lectures in Princeton and elsewhere in the United States were enjoyed rather by seeing than by hearing, i.e. he used to speak few words in low voice, but wrote on the black-board in clear English what he had to say.

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In his autobiography [1], he says that he was a poor pupil in primary and middle schools, being good only in math and in no other subjects, as expressed in its title. I suspect that he was overly modest in entitling thus his autobiography; I believe he certainly did well at least in English in the middle school and in German in the First High School; he entered, by the way, at the top of the class this last school which was known as the best school of its kind at that period. It is true that he was physically of rather small stature and apt to falter in speaking so that he was very shy.

According to [1], he was interested in numbers and played with beans when he was very young. Since he was the third grader in the middle school, he began to attack the thick book "Algebra" by Professor Fujiwara at the Tohoku University. One can imagine that this was hard reading for him, as this book was written for university students and researchers and not for middle school students. Kodaira made the effort, however, to understand it and enjoyed it.

In the First High School, he saw the teachers of mathematics enjoying mathematics so that he wished to become a teacher of mathematics in such a school. I believe that he meant in particular Dr. Aramata, who got an interesting result on the "divisibility of zeta-functions" toward that time and was a good friend of Professor Suetuna at our Department which he often frequented. I had heard also from him of the "exceptionally bright student Kodaira" before he entered our Department.

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As said above, I was in charge of the exercises of Professor Takagi's lectures in 1935-36. I was very lucky to encounter in this class students like Kunihiko Kodaira, Kiyosi Ito, Yukiyosi Kawada, Shigeru Furuya who all became later well known mathematicians.

After the retirement of Professor Takagi, Professor Suetuna succeeded to his chair of arithmetic and algebra. Professor Nakagawa who had been in charge of the geometry course since longtime, had to retire in the following year and I was to give lectures of geometry beginning 1937. In 1936-37, I lectured on modern analysis along the lines of J. von Neumann. I had been impressed by his articles on the theories of Hilbert spaces and almost periodic functions on groups and his book on the foundations of quantum mechanics. These lectures were attended by Kodaira.

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Kodaira says in [1] that he went to visit Professor Suetuna together with Kawada toward the end of 1937 and asked him to admit them to his seminar in the next year. Professor Suetune seemed to accept their proposal and Kawada was admitted in fact, but wrote afterward to Kodaira that he had better study geometry in my seminar. He came then to visit me with the letter of Professor Suetuna and expressed his wish to join my seminar. I have now completely forgotten about the letter of Professor Suetuna, but I was very much pleased to welcome him. Since that time, Kodaira came quite frequently to my house together with Furuya, who was a good friend of his.

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Kodaira was born on March 16, 1915 as the eldest son of Mr. Gon'ichi Kodaira and Mrs. Ichi Kodaira, née Kanai. Both parents originated from the Suwa region of Nagano prefecture, in central Japan. Mr. Gon'ichi Kodaira was a vice-minister of agriculture, a competent administrator and at the same time a scholarly person. The family of the mother of Kodaira was also well known in the Suwa region. Mrs. Kodaira was associated to the so-called no-church sect of Christianism. Thus Kodaira was born into a diligent and intelligent family with a general cultural interest. His father brought back a piano from his official trip to Germany.

Kodaira began to learn playing it since the time he was a third grader of middle school with a student of the Tokyo University who was a good pianist but after a few years he graduated from the University and had to move to another city. Kodaira was left with the student's sister, Miss Tazuko Nakajima, who was also a good musician, but a violinist rather than a pianist. Kodaira was an especially talented pianist, good in particular in sight-reading.

I had, by the way, a sister who played piano and we had also a piano in my house. Once when Kodaira came to visit us, we asked him to play music of Albeniz, Spanish composer, and were amazed in hearing him play it full of sentiment. Miss Nakajima had a number of followers and organized concerts for them once or twice a year and Kodaira used to accompany them. It happened that my sister Seiko was among her followers and Kodaira accompanied her frequently. I do not remember exactly the period when this took place.Anyway, Kodaira and Seiko got married in 1943.

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I said that Kodaira joined my seminar in 1938. I have to tell now what happened in five years 1938-1943. In my seminar, Kodaira studied topology from the well known book of Alexandroff–Hopf together with Makoto Abe, who joined my seminar in the next year. After Kodaira finished the undergraduate course in 1939, he wished to study theoretical physics in the Physics Department of the same Faculty, which he did in 1939-42. He was charged with giving lectures in the Physics Department soon after graduation and one year later he was named lecturer of mathematics at the Tokyo Bunrika University, so that he was secured in a living when he got married. He began to publish his scientific papers from 1937 when he was a student of the Department of Mathematics and continued to publish regularly since then. It was very unfortunate, however, that our country had engaged in World War II since December 1941, which was already turning worse in 1943!

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Kodaira writes in the Introduction to [1]: "I had thought to live always in Japan, enjoying mathematics and music. This thought was completely destroyed by the War."

In fact, the situation of Japan became worse and worse toward 1944-45 and it became difficult to continue to live in Tokyo. The government permitted and even encouraged those of us working in national universities that each Department took refuge in an appropriate place in the countryside, which was, on the other hand, not so easy because people in the countryside did not like to receive a large number of Tokyoites into their regions. For the Departments of Mathematics and Physics of the University of Tokyo, this was made possible by the influence of Kodaira's father: the students and part of the teaching staff of these Departments (as some of the teaching staff preferred to stay in Tokyo) were received in the Suwa region.

I had a chance to visit the native house of Kodaira's father which was a simple farmer's house. Kodaira's family as well as my family, the families of my father and of Makoto Abe, who got married to Taeko, another sister of mine in the meanwhile, all took refuge in this region, where we had to experience, however, the following sad events.

The Department of Mathematics of Tokyo Bunrika University, where Kodaira worked together with Kawada and Abe, took refuge in Shigeno, another place in the Nagano prefecture. Abe, who was not of strong constitution, had to work hard in Shigeno, and came to join Taeko in Suwa to take rest. But it was unfortunately too late and he died there in early 1945.

Out of the marriage of Kunihiko and Seiko, they got a lovely boy Kazuhiko, who developed a kidney illness, very unfortunately, and also died in Suwa in 1946, some months after the end of the War.

The house of Kodaira, as well as my house, in Tokyo was burnt down by American bombardment. In the beginning of August, we heard what happened in Hiroshima and Nagasaki. I was deeply relieved by the broadcast of the Emperor on August 15, 1945 announcing the end of the War, and a brief additional statement of Prime Minister Suzuki which seemed to give us hope for our country to develop in doing other things than a war.

I shall not give a detailed explanation of the scientific works of Kodaira leaving it to the preface of [2], but I shall mention here that since 1944 he was deeply concerned with the generalization of the theory of Riemann surfaces, i.e. the theory of algebraic functions of one complex variable as described in the famous book of Hermann Weyl to the case of many variables. He noticed a result of Hodge whose proof was not perfect but could be rectified by Weyl's "method of orthogonal projection." He noticed also that the cases which were not treated by Hodge can also be dealt with in the same way. He wrote up these ideas in three notes in the Proceedings of the Japan Academy communicated by Professor Takagi in 1944. Meanwhile, the American bombardment became more effective, and the publication of scientific journals in Japan became impossible. I encouraged Kodaira, however, to write a paper giving a more detailed exposition of his result. (Kodaira says in [1] that he did not understand why he wrote such a long paper without knowing whether its publication was possible, but I believe that I encouraged him in the atmosphere of the immediate post-war time. He continued to write this paper even at the bedside of Kazuhiko. There was, by the way, another paper by Iwasawa on topological groups, whose completion I encouraged at that period.) I should recall here, the unusual situation of Japan at that time in which we were not permitted to communicate freely with foreign countries and the kind intervention of Kakutani to help us in this situation. (Kakutani, now professor emeritus at Yale University had collaborated with Kodaira in 1943.) He had been invited to the Institute for Advanced Studies in Princeton before the War and repatriated by the special American ship just after the Japanese declaration of War. After the end of the War, he acquired a number of friends among the Occupation Army. As I told Kakutani of our desire to send the excellent papers of Kodaira and Iwasawa to an American journal, Kakutani asked one of his friends to kindly take care of sending these papers to the Annals of Mathematics, where these paper were accepted and soon published. They appeared in fact in this famous journal and Kodaira's paper attracted the attention of Hermann Weyl. Kodaira obtained thus an invitation letter from Hermann Weyl to the Institute in Princeton in 1949 (though he could not take his family.)

His book [3] contains a number of his letters to Seiko written in the period August 1949 through September 1950, showing how he was amazed in arriving in the U.S. from Japan which was in ruins. I had a chance to see him again in August 1950 when participating in the first International Congress of Mathematicians after the War which took place in Harvard University.

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In 1949, Kodaira had been kindly welcomed by smiling Hermann Weyl, who seemed, however, a little surprised to see him hardly speaking English whereas his papers were written in good English. He proposed to organize his seminar later. A seminar by Siegel and de Rham took place soon, however, which Kodaira was asked to join. Thus a friendship was born between de Rham and Kodaira. Professor Spencer at Princeton University, who came there in just the same year from Stanford, asked him also to speak in his seminar, and the close friendship between them developed further, to a very successful collaboration between them through the whole 1950's.

Kodaira had first thought to stay in the States just for one year, but he obtained offer first by W. L. Chow at Johns Hopkins University followed by offers from other places. His family (Seiko and two daughters Yasuko and Mariko) could join him in 1950 and finally he stayed 18 years in the United States, occupying himself with his scientific works (and the music together with his family.) In the International Congress of Mathematicians at Amsterdam in 1954, he was a co-recipient of the Fields medal together with Jean-Pierre Serre. I had a chance to attend the ceremony where he received a medal from Professor Hermann Weyl and could imagine his heart-felt joy. He was the first recipient of this medal originating from other regions than Europe and North America. After that he received a number of Japanese and international prizes, which I shall not enumerate here.

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I shall conclude this article in recounting a little more about his life after his return to Japan in 1967. He taught at Tokyo University until 1975, then ten more years at the Gakushuin University. He was named dean of the Faculty of Science of Tokyo University in 1972-73 which did not please him, particularly because of students' unrest at that time, but more fundamentally, he estimated himself entirely inappropriate to this kind of rôle. (It seems to me, however, that in fact, he shared the ability of his father as an administrator, but he did not like administrative works necessitating attentions to multitude of affairs. He preferred to concentrate himself rather in deeper questions. The title of his book [3] meaning: Notes of an idle mathematician, may surprise as a title of a book written by such a diligent mathematician. This comes principally, I believe, from his experience as a dean: he seemed idle to himself as he could not fulfil his duty sufficiently well.) In the University of Tokyo, he had such brilliant students as Iitaka and others who are continuing and developing his works.

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His elder daughter Yasuko was married to Mr. Keitaro Hashimoto, Professor of physiology at the Yamanashi Medical University, Yamanashi being a prefecture placed between Nagano and Tokyo; and his younger daughter Mariko to Dr. Mutsuo Oka, Professor of Geometry at the Municipal University of Tokyo.

Toward the end of the 1980's, the health of Kunihiko Kodaira began to decline. He had first troubles in his respiratory system, then in his hearing organ. It was sad to see him having difficulties in hearing and losing the pleasure in hearing music. He was hospitalized in a hospital in the Yamanashi prefecture and passed his last days in a room from the windows of which one can enjoy the view of Mt. Fuji.

After his death in this hospital on July 26, 1997, Seiko has continued to live in the same house in Nakaochiai, Tokyo, together with the Oka family, at the same place where Kunihiko Kodaira had lived with his parents, until the beginning of the January of 2000 when she suddenly died, which was another sad event for me.

REFERENCES

[1] KUNIHIKO KODAIRA, *Autobiography*, Nikkei Science, Tokyo, 1987 (Title in Japanese: Boku wa sansū shika dekinakatta).

[2] KUNIHIKO KODAIRA, *Collected Works, Vol. I–III*, Iwanami Shoten, Publishers, Tokyo and Princeton University Press, Princeton N. J., 1975.

[3] KUNIHIKO KODAIRA, *Notes of an idle mathematician*, Iwanami Shoten, Publishers, Tokyo, 1986 (Title in Japanese: Namake sûgakusha no ki).