

IN MEMORIAM

TARO TAMURA

Taro Tamura died unexpectedly of a heart attack on 10 October 1988, at the age of 65. He was a distinguished theoretical nuclear physicist, who made important contributions to the theory of nuclear reactions and nuclear structure. His work was known and appreciated all over the world, and he had given lectures and short courses on results of his research in almost every country on earth where a significant research effort in nuclear physics is maintained. He received the Argonne Universities Association Distinguished Scientist Award in 1972 and a Senior U.S. Scientist Award from the Alexander von Humboldt Foundation in 1981. He was a member of the Japanese Physical Society and a Fellow of the American Physical Society.

Tamura was born in Akita, Japan on July 12, 1923. He earned an undergraduate degree in naval architecture from the University of Tokyo in August of 1945. This period of his life he would mention later only to his closest friends, and even then usually only as "the darkest days of my life." One of his assignments was apparently to design a sort of manned torpedo or kamikaze submarine! The war over, he returned to the University of Tokyo to study physics, receiving a bachelor's degree in March of 1949 and his Ph. D. in August of 1955. He was a research assistant at the Tokyo University of Education (now Tsukuba University) from 1953 to 1955, a postdoctoral fellow at Niels Bohr Institute in Copenhagen from 1955 until 1957 and at UCLA from 1957 until 1959. He then returned

to Tokyo University of Education as an Associate Professor, leaving in 1962 to become a staff physicist at Oak Ridge National Laboratory. He came to the University of Texas as a Professor in 1968, and remained until the end of his life.

During his 38-year career in physics, Tamura published about 200 papers. His early work (1950 - 55) was mainly in the area of cosmic ray physics, but shortly after he joined the Tokyo University of Education he became interested in theoretical nuclear physics. Tamura's theoretical work was at first rather formal and mathematical, dealing for instance with the relation of nuclear collective coordinates to nucleonic ones, and the application of group-theoretical methods to nuclear spectroscopy. In Copenhagen and at UCLA, he became impressed with the power of a phenomenological approach which combined formal precision with experimentally guided insights into workable approaches and approximations.

Tamura immediately appreciated the importance that electronic computers, beginning to appear in the late 1950's, had for the future of theoretical nuclear physics. At UCLA, he witnessed first-hand the impact of early optical model calculations on the field. His move from Japan to Oak Ridge was motivated almost entirely by the computational power he thereby gained access to. At Oak Ridge he completed his famous coupled channels program **Jupitor** for the description of inelastic scattering to collective excitations of nuclei— over the years it has found widespread use, not only in the fields of nuclear physics and chemistry, but in nuclear engineering and elsewhere. His equally famous article in *Reviews of Modern Physics* (**37**, 678 [1965]) summarized the theoretical work

that led to the creation of **Jupiter**, and its many applications.

In 1966, Tamura became interested in the theory of isobaric analog resonances, and this was one of the major factors in influencing him to transfer from Oak Ridge to the University of Texas, where there was not only a large, fast computer, but a vigorous experimental program generating much novel data shedding light on the role such resonances played in nuclear reactions and scattering. Tamura was always eager to set up arrangements in which he could work closely with experimentalists, and thereby stay abreast of the very latest experimental work in the field. By 1970 he had begun to study a variety of reaction-channel-coupling effects in nuclear reactions, particularly (p,t) reactions. Pursuing these effects into the field of heavy ion reactions, by 1975 Tamura was doing massive exact-finite-range coupled-reaction-channel calculations. During the same period, he formulated a general method for making boson expansions of microscopic collective nuclear Hamiltonians, and for the remainder of his life he was occupied in pushing this complex and powerful method to its limits.

In the late 1970's he became interested in the description of continuum spectra of nuclear reactions in terms of multistep direct reactions, and this approach he also pursued with characteristic vigor for the remainder of his career. During the final year of his life, he had also become interested in some problems in the area of theoretical condensed-matter physics, had completed a paper on gradient expansions in density functional theory, and was teaching a course on low-energy electron diffraction at the time of his death.

No one who ever saw Tamura at work could forget the sight. His energy and powers

of concentration were genuinely impressive. He actually ran to the water fountain so as to provide the minimal interruption to his efforts. In person, he was unfailingly kind, gentle and modest. It was easy to get him to talk about physics, but very difficult to get him to talk about himself, and almost impossible to get him to review his own achievements. Students found him a never-failing source of inspiration, while colleagues and collaborators found him a never-failing source of workable ideas, compact formalisms, and neat computational tricks. His famous computer programs were models of compactness and clarity. He was an effective teacher, preparing densely written lecture notes which seemed to explore every possible ramification of a subject. While a very quiet and private man, Tamura never shrank from getting actively involved in sometimes heated public discussions concerning the value of some theoretical approach or achievement.

Shortly after Tamura came to Texas in the late 1960's he fell seriously ill. He recovered quickly, and seemed to work as vigorously as ever, but at home he developed a number of relaxing hobbies, including painting in oils and watercolor, growing roses and creating beautiful arrangements with them, and listening to classical music. His health remained good until the spring of 1988 when he was troubled by feelings of fatigue, and eventually hospitalized with pneumonia. Even so, he characteristically planned a full summer of activities, including lectures in Japan, Italy, and Czechoslovakia. A heart attack soon after arrival in Japan put an end to these plans, and Tamura devoted his energies to getting well enough to return to Texas in the fall and resume his duties. Unfortunately, a final heart attack occurred within a month of Tamura's arrival back in Texas, where he had tried

to plunge back into his teaching and research duties with his old vigor, characteristically ignoring his precarious state of health. The night before his death he had stayed up past midnight working on lecture notes for his course.

A great scientist, as Taro Tamura certainly was, teaches more by example than in any other way. While students, postdocs and colleagues collaborate with a great man, they have intimate opportunities to learn just what his style of working is like, and can make educated guesses at some of the secrets of his success. Colleagues of Taro Tamura were awed over the years at just how much impact his style of doing research had on students, who often even began to imitate his very distinctive, very compact, neat and precise ball-point penmanship in working through the mathematical intricacies of nuclear theory. One way to make clear the extent and intensity of this impact is by sharing the memories of physicists who worked closely with Tamura over the years. We have edited these as little as possible—mainly for reasons of clarity, or to avoid repetition.

Takeshi Udagawa was Tamura's first graduate student, and remained his closest collaborator over 30 years. He is a professor of physics at the University of Texas, to which he came in 1970 shortly after Taro Tamura had settled down there. He remembers: "I first met Taro in March 1959, just after he came back to Japan from UCLA to take up a position as professor of physics at Tokyo University of Education (Tsukuba University, today). This was when Taro started his own research career after years of postdoctoral study at Copenhagen and UCLA. He was brimfull of energy and ideas. It was almost 30 years ago; at that time I was a first year Ph.D. student, and I have never forgotten the

first meeting we had at the institute. After he asked me a few questions about what I was doing, he started telling me about a problem in which he was deeply involved at the time. The problem had to do with a theory of deformed nuclei, which at that time was very successful in explaining certain properties of these nuclei. But the theory made an assumption which was not at all realistic, and could hardly be justified on physical grounds. Nevertheless, because of its power to explain the available data, it was well-received at the time by many physicists. Taro could not swallow the assumption made in that theory, and was deeply involved in developing an alternate approach. He talked to me with his characteristic enthusiasm and lack of condescension about his new idea for this alternate approach.

“I had never before seen such an enthusiasm in physics as Taro showed me. That, and the way he treated me, left a deep impression— he treated me just as if I were a mature physicist, a colleague. After finishing his story, he asked me whether I was interested in the subject. I answered yes. Then he said simply that we should get started, and he left without telling me anything that I should do! I found myself in a very difficult position, since I had not understood even half of what he said to me. How could I start to work? Nevertheless, I felt very happy; I felt I had already become a physicist!

“Taro was an extraordinary person in most respects. His extraordinary energy impressed everybody. He also had courage and vision. Besides the problem I mentioned, at Tokyo Taro set up two other projects. Both required the use of a high speed computer. As far as I know, Taro was a pioneer in scientific computing in Japan. He foresaw

the tremendous possibilities of computers for realistic theoretical description of complex many-body systems such as atomic nuclei. In 1959 we had, in Japan, only one advanced computer, the IBM 650, which was at the Japan Meteorology Agency. (At about that time, physicists in the U.S. were just starting to use the IBM 709.) This IBM 650 had been imported specifically for studying the behavior of typhoons, which come every year to Japan, causing much damage to property, and loss of life. Now Taro's projects required the use of that heavily-committed computer. It looked to me, and also everybody else, that it was impossible, and that he would never get anywhere with his computer projects.

"Incredibly enough, however, Taro succeeded in getting 20 minutes of computer time per week. Considering the slowness of computers of that era, 20 minutes of computer time was virtually nothing. Nevertheless, Taro made a start. That was a giant step for him, and perhaps for the nuclear community. The situation in Japan was too poor for there to be any possibility of Taro completing either of his projects, but he managed to begin one, which was to carry out coupled channels calculations for inelastic scattering from nuclei. He later completed this work at Oak Ridge, to great success. But even under the nearly hopeless conditions in which he started, he maintained his courage and his vision.

"He was a very warm and kind person. Here is a single example of very many. Immediately after I came to Austin, I learned of the problems of one graduate student, who came from a poor Asian country. He was not doing well academically, and was depressed. At one time, his behavior became so irrational he had to be taken to a mental hospital. He was completely alone and friendless in Austin, but then Taro intervened,

visiting him in the hospital and seeing that he got back on his feet. The student recovered and was able to finish his Ph.D. work at another university in Texas. I met him again after Taro's death, and he told me he felt he had lost his real father. I knew many former graduate students who felt that way about Taro."

Rory Coker first worked with Taro Tamura when Coker was a new postdoc at the Center for Nuclear Studies at UT Austin, and Tamura had just arrived as a visiting professor in 1967. Their research collaboration continued, off and on, for the next 20 years. Coker is now a professor of physics at UT Austin. Here are his memories: "Before I met Taro, I thought I knew what hard work was. I came from a university where the physics graduate students worked hard, often from 9 AM until 11 PM, with short breaks for lunch and dinner. When I got to the CNS I found people worked just as hard or even harder, say from 9 AM until 1 AM the next morning. But then I met Taro! Taro worked long hours, but he worked them with an indescribable intensity that probably made one of his hours equivalent to three or four of my hours. When he had to get up from his desk for some reason, for instance to check his mail, he ran from his office down the hall to the mail room. In fact, my last sight of him, just three days before his death, occurred as he ran from the elevators in RLM Hall to the physics department mail room on the 5th level.

"When we began to collaborate on research projects, I found that he insisted on frequent— at times, more frequent than daily— conferences on my progress. Whenever I brought him a difficult question that had arisen during the course of the research, his face would freeze up into an expression of concentration so intense it resembled an expression

of agony. He would remain silent and motionless, often for many minutes, as I sat trying to think hard too. There were times when we would end this interval both as baffled as before. But more often something magical would happen— Taro's expression would suddenly change to one of ineffable inner peace, and he would say, 'I see...', or 'Ah, now I begin to understand....' I think it was the extreme delight he took in these moments of understanding that at least partially fuelled the intensity of his efforts. If I thought of something first, Taro would listen intently, and then his face would screw up again in concentration as he mentally turned my idea over and over, examining it from every aspect for flaws. Later, when he had graduate students, Taro would turn over to them his densely written notes on some aspect of nuclear theory, and say, 'You must understand everything here *perfectly*.'

"I must admit, too, that Taro took a tremendous delight in finding errors in the theoretical work of colleagues at other universities or research facilities, particularly when these colleagues were competitors developing theories as rivals to his own. After having read over a paper written by a rival, Taro might announce, 'So-and-so's theory is *meaningless*.' Having found mistakes, he would very rapidly write up a paper for publication pointing them out. When the physicists whose work had been attacked responded, Taro was instantly ready with a counter-counter-attack, and sometimes the resulting controversies continued for years. Taro even had colorful nicknames for some of the more persistent of his competitors. A group which had gained a great deal of difficult-to-justify publicity for their work, perhaps because of their location at a prestigious East-coast university and

resulting solid 'political' connections to the 'physics mafia,' he referred to as 'The Gang of Four.' For someone who went out on a limb as often as Taro did during his career, he had to eat a surprisingly small amount of crow. While he made mistakes, as everyone does, they were somehow never serious ones, a fact which would surprise anyone who knew how fast he worked, unless they also understood the fantastic intensity with which he worked.

"Taro spoke English with a strong accent, to which, however, everyone quickly became accustomed. Apart from his accent, his command of English was excellent and colloquial. He both wrote and spoke grammatically, and with precision, never fumbling for an English word. At one time we had several Japanese physicists simultaneously in the Center for Nuclear Studies, attracted by Taro's fame, and I noted that they all spoke English with distinctively different accents, not one even vaguely like that of Taro. When I mentioned this to his wife Fumiko, she laughed and said, 'Taro even speaks *Japanese* with an accent!' Having grown up in a small copper-mining community, he apparently spoke with the Japanese equivalent of what might be called a hillbilly accent! This accent was so much a part of Taro's personal charm that one could hardly think of Taro without thinking also of his distinctive way with words.

"Taro's personality was unusual in many ways. He ordinarily maintained a remarkable natural dignity and reserve, but I noticed he would abandon it instantly if he saw it was making someone uncomfortable, or felt it was inappropriate to the occasion. He was unfailingly kind and supportive to friends, students, colleagues and co-workers, and went out of his way to 'go to bat' for others in circumstances they were unlikely ever to find out

about. Taro displayed a particular fondness for German culture, particularly the music of Bach and Beethoven, and I was not too astonished late one night at a party at Taro's house, where a certain stimulating beverage made from barley, wheat, malt and hops had been freely consumed, to find Taro and an experimental nuclear physics postdoc from Germany lying side by side, flat on their backs on the floor, singing German beerhall songs in soft, nostalgic voices. Taro, like many very intelligent people, had so many sides to his personality that I doubt any one person ever saw them all, not even his lovely wife Fumiko.

"If I had to name one person I have known in my life who was genuinely unique and irreplaceable, I'd name Taro Tamura without hesitation. In eastern cultures, there is the concept of a Master, a man who has progressed so far in certain studies, and mastered such powerful techniques, that he is practically superhuman. I don't think there is any question that Tamura's goal, throughout most of his life, was to become a true Master of theoretical physics. I believe he succeeded many times over."

Horace Bledsoe was Tamura's first graduate student at the University, working with him from 1968 to 1970. He is now a computer analyst at the Texas Education Agency. He says: "I had the great pleasure to meet Dr. Tamura in the summer of 1968 when I was about to enter my third year in graduate school in physics at the University of Texas at Austin. He perhaps never knew how lucky I was when he decided to leave Oak Ridge National Laboratory to continue his research at Texas. If it had not been for him, I probably would never have continued in the graduate program in physics at UT. He made

me feel comfortable in my work in physics at the Center for Nuclear Studies to the point that I decided to stay in school.

“He always strived for a description of physical phenomena that was sensibly sound and mathematically correct. To this end, he worked endlessly. If he were still alive today, he would still be working furiously, whatever his physical condition! The world will surely miss Professor Tamura. I am thankful to have had the opportunity to work with him for a short time.”

Herman Wolter came as a graduate student from the nuclear theory group in Jülich, Germany, to work with Taro Tamura in 1969. He is now a professor of physics at the University of Munich. Here’s what he remembers: “I first met Taro Tamura in 1969 when I came to the University of Texas at Austin for the summer during my Ph. D. work. I was very impressed with the keen interest he took in the work of an insignificant graduate student.

“I then returned to Austin a year later to work with Taro as a post-doc. I had planned to remain only a year, but it turned out that I stayed three! During this time, Taro introduced me to nuclear reaction theory and this has remained a fruitful field for me ever since. We worked in a close group with several graduate students and post-docs. Among them were Teruo Kishimoto and Kum Sang Low, with Takeshi Udagawa and Rory Coker as our direct supervisors and with Taro guiding it all and knowing about almost every detail.

“Taro was a wonderful teacher even when he essentially just listened— while you talked about your newest ideas he would quietly listen, nodding his head from time to time and almost closing his eyes. While you thought that he was completely in agreement with you, a short remark would suddenly make you realize your fatal flaw, if you had not already noticed it yourself during your presentation.”

“Later when we were discussing physics on a slightly more equal basis, it was always very enlightening to talk to him. I admired the scope with which he approached a problem and his insistence while trying to come to terms with it. Probably many people had trouble understanding Taro when they first met him. But once you got to know him everything was very clear.

“In his way of doing physics, Taro was a fighting spirit. He perceived new developments early and worked very hard and competitively to stay at the forefront of them. He fully involved his students and coworkers in all his efforts, from little exploratory investigations to large-scale programming efforts. In this way he significantly contributed to several fields of nuclear physics. He indeed pioneered some of them. He believed very strongly in working close to experiment, putting much emphasis on the confrontation of theory and experiment. Thus he had many good friends in experimental physics.

“I met Taro again for a fairly long time in 1984-5 when together with his wife Fumiko he spent half a year as a Humboldt Prize Awardee in München. He was very engaged then in his work on boson expansions and I very much enjoyed taking part in intense discussions on boson expansion theory at that time. But it was also good to see him relax a little and

enjoy life in München and to discover the Bavarian countryside. He even ventured to read a little Kant in the original German.

“Apart from his intense occupation with physics, Taro was far from being one-sided. He enjoyed music (his house was often filled with it) and art, becoming quite a master at oil painting himself. I remember fondly many lively and cultured parties at his home, wonderfully kept by his wife Fumiko, which gave opportunities for deep discussions on almost everything, often helped along by a good glass of wine. There I learned much about Japan and about Taro’s deep concern for the political, social and scientific developments there.

“I am deeply indebted to Taro Tamura, who was a great teacher, physicist and friend to me.”

K. S. Low was a graduate student of Tamura’s during the early 1970’s, and continued as a collaborator in later years. He is now a member of the physics faculty at the University of Malaya. He remembers: “I worked with Professor Tamura first as a graduate student, then as a postdoctoral fellow, and subsequently in collaboration on various projects over a span of close to twenty years. He taught me not just the basic principles of physics, but also the practical methods of solving realistic problems, and the attitude to have in meeting challenges. In his presence, I knew I would not be lost. His enthusiasm, patience and energy always carried the day. In many moments of despair, when concepts were muddled in my mind, or the Racah algebra did not work out, or nested do-loops somehow got into an infinite loop, I knew he would be available to point out the pitfalls. He was methodical

to the finest degree, and would never permit short-cuts. In tackling any problem, he was thorough and exhaustive. He was always ready to question any assumption and each working step. We graduate students learned to accept his procedures quickly. We knew that working with Professor Tamura was not going to be easy, but that it would surely be rewarding. At the same time, we knew he would not exercise a tight rein on our working schedules. He didn't believe in a 'factory worker' philosophy. Quite the opposite. He had the habit of often introducing each of his graduate students in turn, to important visitors, as his 'boss.' These were not just words. We really carried the onus of having to take care of our own work, with no one else to answer to but ourselves. To this day, I do not know if he fully realized the effectiveness of this simple trick he played on us, or if he simply did it instinctively as a way of getting his students to 'grow up.'

"Professor Tamura held a vision of what lay ahead in nuclear physics that permitted him to lead the way over a span of more than thirty years. He was one of the few great theoretical physicists who not only possessed a thorough understanding of physics, but also the ingenuity to materialize pure concepts into computationally viable equations, and further the skills of a master craftsman to program these often fiendishly complex equations into expressions that the limited computers available to him at any given time could handle efficiently. This rare combination, of a clear understanding of physics and the skills to solve such problems, is perhaps the finest manifestation of post-war Japanese physics. In Professor Tamura, many influences and traditions melded together to produce a researcher fearless and determined and ready to take up any challenge. He was forever

willing to learn, be it the latest add-on to the computer to facilitate some numerical task, or the latest developments in mathematical techniques. His search for answers led him through many areas of physics. He never felt confined by nuclear physics, and his career neither began or ended there. When he told me that he would be starting a new course in solid state physics a month before he died, I could only tell him to take it easy. I knew he would not be held back when he sensed new directions to take, new challenges to meet, new things to learn.

“Professor Tamura made very few demands from life. He asked for little beyond the simple pleasure of devotion to his family, and to his research, sharpened with doses of the world’s great music and art. He painted well himself. Also, the weekend t. v. marathon of football and baseball was a tradition. When we were invited to his house for lunch or dinner, he would invariably take the opportunity to explain to us in his earnest tone the finer details of the tackles and fumbles and strikes, while Mrs. Tamura would be showering us with food and refreshments. This impression of a university don’s simplicity in living sticks in the mind. One can understand his decision to preserve this peace and harmony that he found in Austin, Texas, and to maintain the congenial environment in which he could devote himself fully to work at his leisure, despite tempting offers he got to relocate elsewhere.

“Professor Tamura has left behind a rich legacy in his contributions to the understanding of nuclear states and phenomena, a strong tradition of hard work, a characteristically vigorous approach to problems, and the living example he provided that a lifelong dedica-

tion to physics can be very rewarding. As for us, we have lost both a unique teacher and a unique friend.”

D. H. Feng worked as a postdoctoral fellow under Taro Tamura during 1974 - 76. He is now a professor of physics at Drexel Institute of Technology. Here are his memories: “I first met Taro in the Fall of 1974, after two years as a postdoc in Manchester, England. I knew before coming to Austin that Taro had the reputation of being one of the hardest-working physicists (and one of the brightest nuclear theorists) in the world. I soon found that his reputation was misleading in one respect: Taro must certainly have been *the* hardest working physicist in the world! I remember one evening in the physics department’s computer center on the 10th level of RLM Hall (this room is now Prof. Coker’s office!). It was extremely late, considerably past midnight, and I knew that Taro was supposed to leave for a lecture in South Africa early that same morning. So, like a fool, I asked him: ‘Taro, don’t you need to go home and pack?’ Without any hesitation, not even looking up, he answered: ‘*Wife pack, I work!*’ (It is lucky for Taro that all these years he had one of the best wives in the world. Not many women any more would tolerate such an attitude.)

“Taro loved physics. His entire life was consumed by physics. He was also extremely intense about what he was doing. I can recall an amusing example of the way he could immerse himself completely in physics: in the Fall of 1974, he and I went to an American Physical Society Division of Nuclear Physics meeting in Pittsburgh. As usual, during the three or four days we were at the meeting, Taro was involved in almost continuous discussions with other theorists about the then-recent developments in nuclear reaction theory,

the distorted-wave Born approximation (DWBA), the coupled-channel Born approximation (CCBA) and the coupled-reaction-channels (CRC) method that had been pioneered at UT. Obviously, many people considered him to be one of the leaders, if not *the* leader, in the field. When the meeting was over, he and I got into a cab to go to the airport. The cab driver turned around and asked us which airline terminal we needed to be taken to. Again without hesitation, Taro answered, 'TWBA!'

"As I look back over my career, I consider myself very fortunate to have had the opportunity to collaborate with many good physicists. I really hadn't stopped to realize, until Taro's untimely departure, how much I had learned from him and how much he meant to me as a man, as a friend, and— if I may use an overused phrase— as a role model. I am certainly going to miss him very much!"

Yosio Kondo became one of Tamura's postdocs in 1980, staying for two years before accepting a faculty position at the Research School of Physical Sciences at the Australian National University, Canberra, where he is at present. Here are some of his memories: "The first time I met Taro Tamura was in the mid '70's while he was visiting Japan as a 'foreign visitor' supported by a Grant-in-aid for Scientific Research from the Ministry of Education, Science and Culture. He must have stayed overseas long enough to qualify as a 'foreigner' in the eyes of Japanese bureaucrats! We met at a *kissaten* (tearoom) in Kyoto. He was with his elder daughter, Tamako. We had a chat about the cultural differences between Japan and the USA, the attitudes of the people, the price of clothing, etc. At this time I did not expect to experience these differences at first hand myself.

“After staying at Yale University and the University of Pittsburgh, I moved to the University of Texas at Austin in September 1980 and joined Taro’s group as a postdoctoral research associate. I remained there for two years before moving to Australia. During this period in Austin, Taro helped me and my family in numerous ways. For instance, I was attending an APS meeting in Minneapolis in the Autumn of 1980 when my daughter back in Austin fell ill. Taro personally took her to Dr. Dyo, a local Japanese pediatrician.

“On questions of physics, Taro and I argued a lot. Sometimes we became too excited. Taro used to apologize to me later, even if the argument originated from my insufficient explanation. He must have been very open-minded. Of course he was famous for being such a hard-working person. One of his features which impressed me most was the fact that he had a very youthful mental outlook.

“Japanese have difficulty addressing their Japanese superiors by their first name. For non-Japanese people, it may be hard to imagine that a first name is considered an impolite manner of address, since in the USA this is an indication of friendliness. Japanese living overseas frequently find this to be a dilemma. But Taro for me was an exception— even though he was a fellow Japanese I found myself addressing him as ‘Taro’ in the American fashion without hesitation.”

Valento Pedrocchi, as a UT Austin physics graduate student from Italy, who had previously done graduate work in Russia, first encountered Taro Tamura in the summer of 1979 and was still one of his closest collaborators at Taro’s death nearly 10 years later. Here is his story: “I arrived in Austin in June of 1979. My application to the Graduate

School of the University of Texas at Austin had been only half approved. I needed to take the English (TOEFL) and GRE tests, which meant I had to learn English fast. Dr. Austin Gleeson, then the graduate advisor for physics, told me that the tests weren't a big deal. During the summer of 1979, I learned enough English to pass the TOEFL, but that did not make me what one might call a fluent speaker. In my application I had indicated that I intended to pursue my Ph.D. in the field of elementary particles, the same field in which I had worked for my Masters' degree. However, when the Fall Semester started, I decided that maybe I should study something else. Prof. T. A. Griffy, then the chairman of the department, suggested several alternatives to me, including switching to electrical engineering— which, from my present point of view, would not have been such a bad idea. But, back then I was horrified at the thought of having to work with anything that smelled of hardware. Another of the chairman's suggestions was nuclear theory. The nuclear theory group, I was told, was rather small but extremely active. The Principal Investigator was Taro Tamura.

"The very same day I went up to the 14th floor of Robert Lee Moore Hall, where Taro's office was located. During the ride in the elevator I prepared my speech, using all of my rudimentary English. Basically, I just wanted to investigate the possibility of joining the group. I wanted to know what the group was working on, and whether there were any opportunities for financial aid. I had no intention of making a final decision just yet.

"I do not remember just what I muttered to Taro during that first meeting. But ten minutes or so after I had introduced myself, I was sitting at a desk in an office adjacent

to Taro's. I had a project to work on, three long, full boxes of computer cards, and a part-time research assistantship! I was somewhat taken aback, to put it mildly. What had happened? I sat down for quite a while thinking that maybe I should go back to Taro and explain myself better. But I didn't. That was my first taste of Taro's driving style, a style that seemed to me at the time somewhat at odds with Taro's kind manners and the overall gentle image that he projected.

"During the following three years as a graduate student, I had the opportunity to discover many of the facets of Taro's style and character. Like all of Taro's students, that very first day I was also bewildered by Taro's pedagogical approach. I couldn't help but think about the way the Navy is supposed to train new recruits who can't swim. They are simply thrown into the water. So I felt about my new assignment. I knew practically nothing about nuclear structure or nuclear structure theory, and yet there I was with a specific problem concerning a specific nucleus, a three or four thousand line computer code, and a deadline of sorts, three or four months. What I didn't know that day was that an essential part of Taro's teaching method was to *be there for his students, all the time*. He would be there to answer my questions about Racah algebra, about physics, about how to read and run his computer code. He was there.

"Tamura was a theoretical physicist, but he sometimes called himself 'a practitioner.' He was a master of complicated mathematical manipulations. But he was not a believer in mathematical models *per se*, especially simplified models. The models had to be realistic. They had to contain some physics and explain something. Although ignorant of nuclear

structure, I had my opinions about the role of mathematical models, and I was stubborn. This aspect of my character irritated Taro at times and led to some heated discussions, since Taro was rather stubborn himself.

“In 1979, Taro and one of his post-docs, Ken Weeks, were working on the so-called *Boson Expansion Theory* (BET), which is one of Taro’s major efforts and contributions to nuclear structure theory. The formalism for this model had been worked out by Tamura and Teruo Kishimoto during the previous eight years or so, and was now being extensively applied to fit, rather successfully, a wide range of experimental data. The boson model was based on the well-known fact that low-energy spectra of many nuclei exhibit an approximate boson excitation pattern. This suggested that the protons and neutrons in the nucleus somehow couple into fermion pairs of integer spin, which then behave collectively to give rise to the observed boson-like spectra. The mathematics of Taro’s model consisted of a technique for starting with the original fermion problem and transcribing it into a boson one, the reason for the transcription being that the boson problem is much easier to handle mathematically and much more transparent to interpret physically.

“The year 1980 was a crucial one for our BET. Two papers appeared that cast serious doubts on the validity of the theory. One, by E. R. Marshalek, showed by applying the BET to a simplified model that the theory was mathematically ill-founded. He called our BET a ‘chimerical boson expansion.’ The other paper, by A. Arima, used the BET to perform calculations for another simplified physical model and showed that the numerical results were rather poor. Taro was outraged. His reaction was simply to dismiss the

results of the two papers. After all, the results were obtained by applying the BET to systems that were not at all realistic, whereas Taro knew that the BET worked quite well in describing the excitations of many real nuclei. But I felt uneasy. Did everybody else in the nuclear physics community think we were working on *a crackpot theory*? I was particularly disturbed by Marshalek's results, which were, as far as I could understand, correct.

"I spent the next two years as a graduate student, and part of my five years as a post doc, fighting with Taro over Marshalek's paper. As I said above, Taro could be stubborn at times! But little by little he finally concurred that we had to respond to Marshalek's results. And he also agreed finally that, at least sometimes, simplified mathematical models could be used to elucidate mathematical aspects that are all but impossible to see in realistic models. Our work on the formal aspects of the BET turned out to be rather successful. We were able to clarify many controversial points, and to show that the BET used for practical applications was in fact mathematically sound. The misunderstanding turned out to be rooted in the fact that actually not one, but two different BETs had been developed by Kishimoto and Tamura, although the authors themselves did not fully realize it at the time. Arima's results and conclusions also originated from the same confusion. In 1984, we were joined by another post doc, C.-T. Li, who even more than myself believed in mathematical models. Together we published several papers on the formal aspects of BET, including at least three using simplified models, which turned out to work to our advantage when used properly.

“By 1984, Taro was quite satisfied with our work and results. Now it was time to get back to **real physics**. We then developed a new boson formalism, still based on the same physics as the old BET, but mathematically far simpler. Three new graduate students were assigned to work on our new formalism. Their task was to work out the formulas, write a computer code and apply the new BET to nuclear data.

“Toward the end of our collaboration, Taro’s and my positions were still different, but much closer. Taro had helped me in working out the details for my study on formal aspects of the BET. At the same time, I had come to appreciate the physics and his emphasis on understanding the physical motivation of formalism. Unfortunately, Taro could not pass on to me his physical intuition. That is not something one can teach or learn.

“When Taro died, there were still two BET projects in progress. But these were not the only projects he had going. At 65, Taro was full of energy and ideas. I could not really keep up with him. I was content just being able to stay with him on one project. It was a bad time for him to go away. Too many things going on. Too many people depending on his day-to-day guidance. The last time I saw Taro he was running (literally) down the hall. He was rushing somewhere. In my mind, this image typifies Taro’s style. He could never just take it easy.

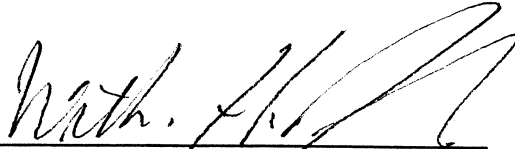
“Taro liked roses. He was proud of his flower garden. He would mention his roses every time he invited me to his house. In spite of our sometimes rocky relations at work, or maybe because of them, I always felt comfortable with Taro. I felt at times like a member of his family. I always felt welcome in his house, where Ms. Tamura would invariably

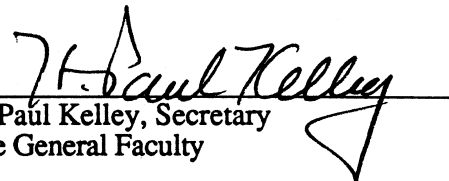
serve wonderful foods. (The first tip that Ken Weeks had given me when I joined the Nuclear Group was never to miss one of Ms. Tamura's parties.) Once, I was even given the responsibility of barbecuing the steaks.

"Now Taro is gone. But not really. His work will live. His ideas will continue to affect and influence the work of many people. His kindness will remain in the memory of all of us who knew him personally. For me, Taro is still sitting at his desk in his office, working on something, smoking his pipe, and wondering who the next visitor will be."

Tamura, during his 26 years of life in the United States, maintained close ties with Japan, ties of family, friends and colleagues, ties of culture, and ties of physics. He carefully followed every fluctuation of the Japanese economy, and of Japanese nuclear physics. At times he considered returning to Japan, but was concerned that such a move would result in a big and unpleasant upheaval both in his lifestyle and his style of doing physics. During the final decade of his life, he channeled his feelings for things Japanese into a passionate interest in the furthering of close scientific cooperation between the theory group at Texas and various groups and individuals in Japan.

Taro frequently expressed his love for both his native land of Japan and his adopted land of Texas. He spoke particularly of his admiration for the arid beauty of the Hill Country west of Austin, as well as for the generous, friendly and independent spirit that he found characteristic of Texans. The Hill Country strongly influenced his initially Oriental style of painting; the independence of Texans fit very well with his style of doing physics.


William H. Cunningham, President
The University of Texas at Austin


H. Paul Kelley, Secretary
The General Faculty

This Memorial Resolution was prepared by a special committee consisting of Professors Takeshi Udagawa (Chairman), Rory Coker and Austin Gleeson.