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Jimpei Harada (1931–2023)

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Thirty-five years ago, Professor Jimpei Harada told me, 'If you understand diffraction, that's enough.' He employed me as his Assistant Professor and opened the door to my becoming a crystallographer. On 9 February 2023, at the age of 92, he passed away. Just recently, though, I heard he was still energetically working beyond the age of 90, and I still find it hard to believe that he is no longer with us. Professor Harada had a deep appreciation for art and good food, and, most of all, had a deep passion for crystallography.

Professor Jimpei Harada devoted himself to advancing crystallography in Japan and the Asia-Pacific region. He served as the President of the Crystallographic Society of Japan in 1992 and was an active member of the Executive Committee of the International Union of Crystallography (IUCr) from 1990 to 1996. Along with Professor Sydney Hall of the Crystallography Centre at the University of Western Australia, he established the Asian Crystallographic Association (AsCA) through the collaboration of Japan and Australia. He also led the management of the organization as its Treasurer.

In 1989, owing to the international isolation of the People's Republic of China following the Tiananmen Square incident, there were concerns about holding the 16th IUCr Congress in Beijing in 1993. However, Professor Harada persuaded Western countries that the Beijing Congress was an important milestone in promoting crystallography in the Asian region and the IUCr Congress was successfully held in Beijing, hosted by the Chinese Crystallographic Society.

In addition, in 1993, Professor Harada worked with Dr Steve Wilkins (1946–2013) of CSIRO to realize the Australian National Beamline Facility at the Photon Factory of KEK (High Energy Accelerator Research Organization). The importance of his contributions was evident when news of his passing was announced, as messages of condolence were immediately received from, among others, Dr Andrew Stevenson (ANSTO Australian Synchrotron), Dr Zwi Barnea (University of Melbourne), Professor Dudley Creagh (University of Canberra), Dr David Cookson (ANSTO) and Dr Richard Garrett (ANSTO).

Jimpei Harada graduated from the Department of Physics at the Tokyo University of Science in 1953 and then went on to graduate school at the Tokyo Institute of Technology, where he obtained a PhD in science in 1964. After that he held various positions, including Assistant Professor at the Tokyo Institute of Technology, researcher at the University of Melbourne, senior researcher at Brookhaven National Laboratory, and Assistant and then full Professor at the Department of Applied Physics, Faculty of

Engineering, Nagoya University. After retiring in 1994, he became an Emeritus Professor at Nagoya University, a Professor in the Natural Science Department at the University of Electro-Communications and, in 1996, the Director of the X-ray Research Laboratory at Rigaku Corporation. He also served as a member of the Radiation Facility Committee at KEK. He dedicated himself to education and research for many years.

Over his half-century of research, Professor Harada maximized the use of quantum beams, such as electron beams, X-rays, neutron beams and synchrotron radiation, as tools for crystallography research. He led the way in establishing the fundamental principles of crystallography, developing measurement devices, and promoting and applying crystallography in industry. Professor Harada was at the forefront of the transformation of crystallography brought about by technological innovations in light sources.

Professor Harada initially started studying crystallography by developing a sample rotation device inside an electron microscope with Professor Goroh Honjo. While observing Si single crystals from various crystallographic orientations using electron diffraction, they discovered diffuse scattering. This phenomenon was later observed in X-ray diffraction as well. On the basis of these findings, Professor Harada proposed a theory on the existence of low-frequency transverse waves (phonons) that are strongly dependent on the crystal structure. This theory was established through the diffuse scattering of $BaTiO_3$, which provided experimental evidence for the existence of soft phonons, as previously suggested by Cochran in 1959. This achievement had a significant impact both domestically and internationally at the time, as $BaTiO_3$ was being recognized as a cutting-edge material. At the IUCr Congress held in Melbourne in August 1965, Professor Harada was highly praised by Kathleen Lonsdale (then the Vice President of the IUCr), M. Blackman and Professor Guinier of France. As a result, he was invited to work as a researcher at the Australian Institute of Nuclear Science and Engineering from 1966 to 1968.

While in Australia, Professor Harada worked with Professor J. M. Cowley's research group and developed a new analysis method that complementarily utilized neutron and X-ray diffraction data. This method resolved the problem of the arbitrariness of structural analysis results due to the strong correlation between structural parameters in the tetragonal phase of $BaTiO_3$, which had been considered to be essentially unsolvable at the time (Harada *et al.*, 1970). From 1968–1970, he worked as a member of Dr Gen Shirane's neutron inelastic scattering group at Brookhaven National Laboratory, researching perovskite crystal phase transitions and soft modes. His work on the atomic level elucidation of the displacement-type ferroelectric phase transition in $BaTiO_3$ was considered a pioneering achievement in materials structure science [see for example Harada *et al.* (1971)].

Professor Harada then achieved significant progress in the field of crystallography that led to the creation of the area of research that concerns dynamics in materials. He established correction formulas for thermal diffuse scattering with Professor Makoto Sakata, determined short-range order by quantitative measurements of diffuse scattering with Dr Kenichi Oshima, solved surface and interface structures by crystal truncation rod scattering, and performed precise structure analysis, including anharmonic thermal vibrations, by neutron scattering.

Throughout that time, Professor Harada worked on developing 'bright' X-ray sources for observing weak diffuse scattering intensities. To achieve long-term operation of rotating anode X-ray generators, which are powerful X-ray sources used in laboratory settings, he introduced magnetic seals to the vacuum-holding mechanism of the target rotation section. As a result, the average operating lifetime of a rotating anode was extended from 100 h to over 1000 h, and they are still in use today. In 1986, he also collaborated with many other researchers to install a large six-axis diffractometer at the Photon Factory BL4C beamline, laying the foundation for advancing materials structure science.

Professor Harada repeatedly told Professor Sakata, who was then an Assistant Professor at Nagoya University, 'Professor Norio Kato works on dynamical theory, I work on scattering, and you should find your own area of research', which led Professor Sakata to start researching the maximum-entropy method. At the pub that Professor Harada nicknamed 'upstairs', he often shared this story with others, including myself. I believe that he taught us that having our own unique research area is what makes us competent researchers.

Professor Harada was like a father figure to me, always showing concern and checking up on me when I transferred from Nagoya University to Shimane University and later on when I moved to Tohoku University to work on the realization of the next-generation synchrotron radiation facility, NanoTerasu. It is my utmost regret that he was not able to make the visit to NanoTerasu that Professor Michiyoshi Tanaka and I had planned for him.

To conclude this account of Jimpei's life and achievements, I would like to borrow the final words of Professor Dudley Creagh's message of condolence: 'Vale Jimpei ... a true friend and colleague.'

References

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