Mendelssohn Award Lecture

Our life with cryogenics

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We are very grateful and feel truly honoured by receiving the Mendelssohn Award. And that it happens just here, at the 20th International Cryogenic Engineering Conference, makes it even more special. The information on this decision of the ICE Committee came as a big surprise – and of course it made us look back on our 47 years of joint activities before and with cryogenics.

Don't worry, neither I nor my husband, Gustav, will speak about new developments in physics or engineering – that was much better done during the scientific sessions of this conference. We will just tell you a bit about our personal experiences with cryogenics.

We met a very long time ago, in 1946, one year after Word War II, when we both enrolled at the Technical University Berlin, Gustav for studying Engineering and Physics and I for studying Chemistry. At that time studying was a kind of adventure: Berlin had been severely destroyed by bombs and fighting. From TV reports on this topic you will know what this means. At our university only one larger lecture hall had survived the general destruction, laboratories were rare and overcrowded, and laboratory work meant a lot of improvisation. During the first term the university had only 1200 students, and the number of professors with a clean political background was quite limited. Living conditions were complicated. But soon friendships among the students were born from the need to help each other, and in spite of all hardships we had a strong feeling that things could only get better, and life was full of promises. For the two of us these promises came true in a way which we could not even dream of at that time.

At the university and during our professional life we had the good fortune to meet a number of great personalities who became our guides, mentors and friends and also gave us the chance of new, lasting experiences. This is a good opportunity to remember them with gratitude.

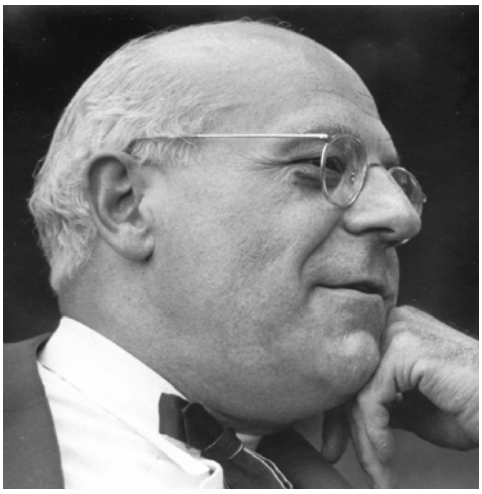

Figure 1 Iwan N. Stranski (1897-1979)

The first was Iwan N. Stranski (Fig.1), Professor of Physical Chemistry at the Technical University and a well-known specialist in crystal growth. Students of physics as well as chemistry had to take his courses, and both of us were soon fascinated by the subject as well as the man and decided for him as mentor of our Diploma and Doctoral theses. Due to the lack of laboratories at the university, we got the chance to do our thesis work at a research institute, the former "Kaiser-Wilhelm-Institut für Physikalische und Elektrochemie", today known as "Fritz Haber Institute of the Max Planck Society", where Prof. Stranski headed the Department of Crystal Growth. Gustav joined this institute in 1950, I followed in 1952, and we worked both with Prof. Stranski for a number of years and on different topics, first as students and then as assistants. Among other subjects we learned a lot about crystal growth during this period.

After having spent the larger part of our youth in Hitler's Germany with its restrictions and uniform, aberrant ideas, Prof. Stranski opened new horizons to us. He was an internationally experienced, open-minded, critical teacher as well as an intellectually stimulating, quick-witted speaker, and in his seminars and as his assistants we got to know many well-known scientists from around the world. He had no

illusions about the world and the behaviour of human beings and could be quite cynical, but nevertheless he taught us above all to be generous, whatever the question might be. Over the years he became a fatherly friend whom we owe thanks for very much.

Here a short digression may be allowed: our student friendship had by and by developed into a closer relation, we married in 1957 (Fig. 2), had two daughters in the early sixties, and this average family of four has by now become a rather large clan with two sons in law and the astonishing number of seven grandchildren. – Although the photo may look like it, our life consisted not entirely of science or cryogenics!

Figure 2 The authors in 1957

In 1951, around the time when we joined the Fritz-Haber-Institute, Max von Laue (Fig. 3), world-famous theoretical physicist and Nobel Prize Winner of 1914 for the detection of X-ray diffraction in crystal lattices, became its Director. Under Hitler he had stood up for Albert Einstein and what was then called "Jewish Physics" and had therefore been forced to retire early from his professorship in Berlin. After the war he actively engaged himself in the rebuilding of German scientific institutions and, in spite of his age of 72, agreed immediately when he was asked to overtake the burden of heading our institute. He had worked with Max Planck in Berlin for several years before 1910 and had been one of the group of seven Nobel Prize winners in Berlin who in the 1920s met weekly in a famous seminar for discussing the latest developments in physics and chemistry. For us, he and the numerous famous physicists he knew well and invited to the institute somehow bridged the gap between our time and the glorious heyday of science in Berlin at the beginning of our century before Hitler came into power.

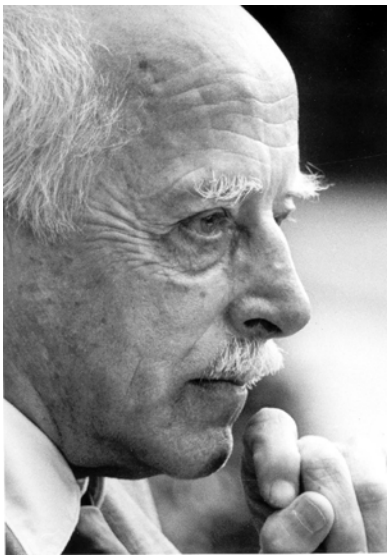

Figure 3 Max von Laue (1879 – 1960)

Professor von Laue became another fatherly mentor, and he gave our life the deciding turn towards cryogenics. Although he was a theoretical physicist, he was fascinated by modern technology in all its varieties. In the 1930es he had seen the attempts of the Kaiser-Wilhelm-Gesellschaft to set up a Low Temperature Laboratory in Berlin, which failed due to the beginning of the war. When in the mid-1950es the first Helium liquefiers came into the market, he was immediately taken by the idea to realise this earlier plan by installing such a plant at our institute, where many researchers were interested in Helium temperatures for their projects.

Before the mid-1950s production of low temperatures and research in this temperature range was the sole domain of only a handful of specialised institutes around the world, like the well-known Kamerlingh-Onnes Laboratory at Leiden, The Netherlands, or the Clarendon Laboratory at Oxford, England. At the average university, low temperature physics was not a subject of teaching, and 'cryogenic engineering' was yet unknown. As a consequence specialists were scarcely available when cryogenics began to emerge as a field of engineering

In January 1957 Prof. von Laue therefore asked Gustav if he would be willing to set up a low temperature laboratory. He knew that before becoming a physicist Gustav had been a navy engineer during the war and was trained in the operation of complicated machinery. A 4-l-Meissner Helium liquefier, the very first one manufactured by the Linde Company, was installed (Fig. 4), and the Fritz-Haber-Institute became thus the first non-low-temperature institute in Germany with low temperature facilities. Well aware of this unique position,

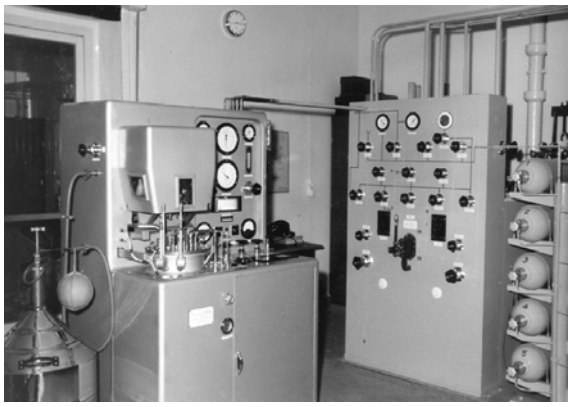

Figure 4 The first 4-l-Linde liquefier at the Low Temperature Laboratory, Berlin, in 1957

Max von Laue generously invited researchers from other institutes in Berlin or elsewhere to come as guests and use these facilities for their experiments.

The tasks of the new laboratory were defined as shown in Table 1. These tasks remained valid throughout the next 35 years. Max von Laue took a lively interest in the work going on, but he did not give any directions – the head of this laboratory was free in his decisions regarding handling of the plant as well as the work of his group. Fortunately, even this condition was never questioned in later years.

Table 1 Tasks of the Low Temperature Laboratory, Berlin

- Liquefaction of Helium and Nitrogen
- Development of cooling methods and cryogenic equipment for any required application
- Know how transfer to the users
- Low temperature research

At the beginning we could not imagine what it meant to enter a new, developing field of research and development with this amount of freedom in one's decisions. The laboratory was well equipped with technical and academic staff, and even funding was never really a problem because fortunately we had always a sufficient number of research and development projects going on.

Although I continued to work with Prof. Stranski for a couple of years until his retirement, I slowly 'diffused' into cryogenics by reading and starting a literature card file – such helpful tools as computers were not yet available! Later I was lucky enough to get a position in the Low Temperature Laboratory, and from then on we worked together until our retirement. Over the years, at work we became a kind of 'Cooper pair' – not directly linked but efficiently interacting over a certain distance, which in the average was less than 50 meters. Gustav has often been asked by colleagues, especially from the industry, how he could stand it to have his wife around even at work! Well, they obviously didn't know much about Cooper pairs! For us this close co-operation was fulfilling and rewarding, and we never got bored of each other due to a lack of topics of mutual interest.

Figure 5 The second Helium plant at the Low Temperature Laboratory Berlin: capacity 10 l/h, CTi, USA

Being an engineer, Gustav attempted to run the Helium plant under the engineering aspects valid for any machine: as continuously as possible and up to its limits. In the beginning this was a rather unusual attitude in the case of Helium liquefaction. Maintenance and repair time of Helium liquefiers still exceeded or was at best equal to the running time, and for many years most liquefiers in German institutes were operated only occasionally. Under these circumstances our total output of meagre 600 l in the first year, 1958, was considered a record. However, conditions improved, by and by bigger plants were installed (Fig. 5) (Fig. 6), and thus the liquefaction capacity was stepwise increased in accord with the growing demand (Fig. 7). 40 years after its start the laboratory supplied about 200.000 l liquid Helium per year to users in Berlin. Throughout this long time, we could always deliver any required amount of liquid exactly in time.

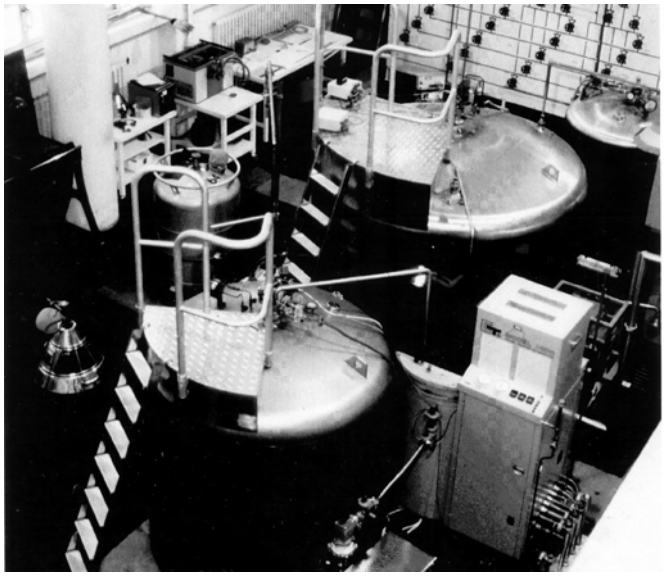

Figure 6 The actual Helium plants at the Low Temperature Laboratory Berlin: Capacity 2 x 50 l/h; CTi, USA

When more and more low temperature

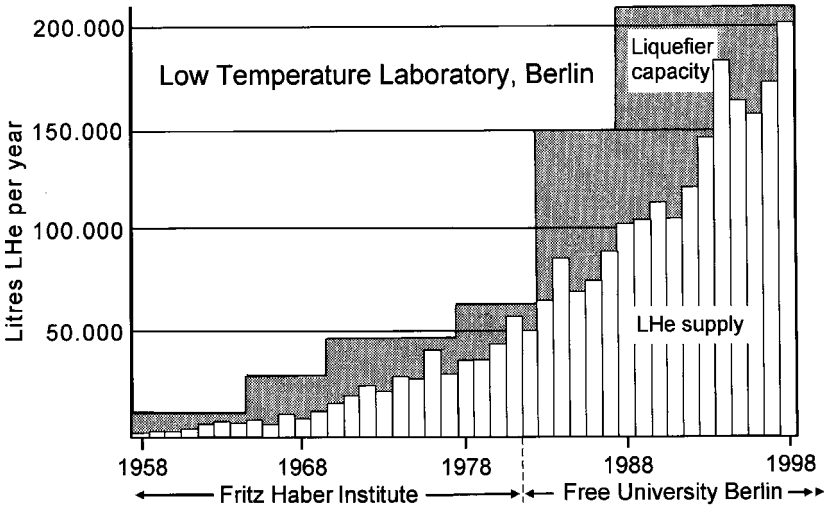

Figure 7 LHe production capacity and amount of liquid supplied

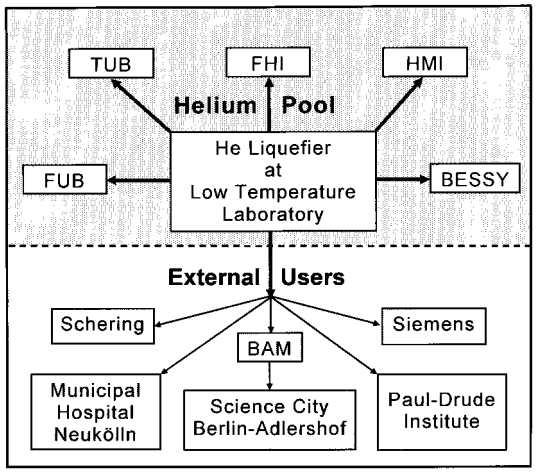

Figure 8 LHe supply to users in Berlin by the central Low Temperature Laboratory

experiments were set up in different institutes in Berlin, a number of them decided to economize Helium supply by setting up a non-profit "Helium Pool" (Fig. 8). The Low Temperature Laboratory acted as central facility which delivered liquid Helium to the members at cost price and provided know how regarding the economic use of the coolant as well as the development of cooling methods or design of cryostats for specific applications It also served a number of "external" users, institutes and also industrial laboratories, who did not belong to the Pool. In 1982 the expanding laboratory moved with plants, experiments and staff into the newly built Department of Physics of the Free University Berlin. Over the years this university had become one of main users of liquid Helium and could now provide ample space for the laboratory in its new building.

Regarding research and development at the Low Temperature Laboratory I will just give a few examples (Table 2). We began with the focus on *cryopumping* – which is nothing but crystal growth on cold surfaces, something for which we were well prepared from our work with Prof. Stranski. In the 1950es the development of efficient cryopumps was still in its infancy. Many basic questions regarding growth and evaporation of the condensed gas layers needed answers. Another main subject was the development of *continuous cooling methods* with accurate adjustability of any desired temperature in the range from 1.5 to 300 K. The invention of the continuous flow cryostat was the first step, and this problem never lost actuality throughout the years. In this context we also took up research on *Helium II properties and its flow behaviour* in narrow channels, with the aim of developing reliable automatic He II refilling devices. This came in useful when in the early 1970es we became involved with *space cryogenics*. He II cooling of infrared space telescopes and the development of qualified cryocomponents for space application became subjects which occupied us for about 20 years. Finally, I should mention *Magnet Resonance Imaging*. When in 1983 the first MRI system was installed at a university clinic in Berlin, we were asked for support on the cryogenic side. The early MRI systems needed refilling of about 500 l LHe every 4 weeks. We did not only deliver the liquid Helium and refill the MRI cryostat, but soon saw possibilities for improving the refilling process. By stepwise changes in the refilling and control system we could achieve a reduction of the refilling time from 7 hours to only 1 hour – a fact which was much appreciated by the medical doctors in view of the high treatment costs: at that time about 1700 DM per hour.

Table 2 Main research and development areas of the Low Temperature Laboratory, Berlin

- Cryopumping
- Continuous cooling methods for temperatures T = 1.5 – 300 K
- Heluim II properties and its flow behaviour in narrow channels
- Space cryogenics
- MRI cooling

Gustav's election as Member of the International Cryogenic Engineering Committee in 1969 as well as our engagement in the scientific and technical cooperation between Germany and India were essential steps towards activities on the international level – something which Gustav will talk about in more detail.

Our world widened immensely. We worked in joint projects with colleagues in the USA, India, Japan, China and the USSR, spent time in these countries and had many guests from abroad in our laboratory as well as in our home. This gave us new insights, brought memorable experiences and gave us the chance to make friends around the world – something for which we are deeply grateful.

Our relation to cryogenics can best be summarised in a short Limerick verse:

Although we are now grey and old,
we are still in love with the cold.
It was always demanding,
surprising, rewarding,
and a challenge which still does hold.

At first let me once more express our thanks for being honoured by the Mendelssohn Award. We were lucky in many aspects to get involved with cryogenics at an early stage and are grateful for the many chances we had by working in this field. As Ingrid already has indicated, being a Member of the International Cryogenic Engineering Committee certainly belongs to them. I will give here a short summary of some experiences related to the Committee's work.

Up to the 1950s low temperature physicists could not foresee that temperatures T < 77 K might be used for large-scale technical application already in the near future. The change came with the growing (military) interest in powerful long-range rockets, which needed large amounts of liquid Oxygen and liquid Hydrogen for fuel. Cryogenic engineering began to emerge as a recognised field, especially in the Soviet Union and in the USA. The beginning of the space age, which is marked by the start of the very first satellite "Sputnik" by the Soviet Union in October 1957, gave a further strong impetus to its development.

Figure 9 Kurt Mendelssohn (1906 – 1980)

The US National Bureau of Standards' Cryogenic Laboratory – a government funded central laboratory – was founded at that time and officially opened in 1954. In conjunction with this event a successful Cryogenic Engineering Conference (CEC) was held, which turned out to be the beginning of the long and successful series of CECs. Although international attendance at these conferences increased over the years, they did not really cover the needs of the developing cryogenic communities in Europe and Asia. This problem was early recognised by Kurt Mendelssohn (Fig. 9), who headed a research group at the Clarendon Laboratory in Oxford, England. He was born and grew up in Berlin and studied physics at Berlin's Humboldt University in the 1920s. Here and later at the University of Breslau he worked in the group of Franz Simon (later: Sir Francis Simon), where in the context of research on Nernst's third law of thermodynamics he became involved in low temperature production and measurements. In 1933 Franz Simon, Nicholas Kurti and also Kurt Mendelssohn emigrated to England, where F.A. Lindemann (later: Lord Cherwell), former student of Walter Nernst in Berlin and since then profoundly interested in low temperature research, found places for them at the Clarendon Laboratory, which in turn became one of the leading laboratories in this field.

Figure 10 Keichi Oshima (1921 – 1988)

Kurt Mendelssohn discussed the imbalance of information on cryogenic technology in Europe and Asia compared to the USA foremost with Keichi Oshima (Fig. 10), Professor of Technical Physics

and Director of the Low Temperature Laboratory at the University of Tokyo. The latter served his country in many important positions at national as well as at international level (OECD) and was a strong promoter of new technologies in Japan. Often he expressed his opinion that it would be one of the essential requirements for a positive development of world politics to overcome the poverty in Asia. And new technologies he considered to be a suitable means for reaching this goal. Being aware that conferences focussing on the aims and possibilities of upcoming new technologies are essential for activating support for these fields, he shared Kurt Mendelssohn's view that conferences similar to CEC would be required in Europe and Asia. Correspondingly, he proposed to organise an International Cryogenic Engineering Conference at Kyoto, Japan, in 1967 as a first try. Its success led them to think about an International Cryogenic Engineering Committee which could act as organiser of a new series of international conferences to be held more or less alternately in Europe and Asia. Kurt Mendelssohn became active and soon convinced a number of cryogenic specialists of this idea. Already in March 1969 the International Cryogenic Engineering Committee was set up at a Meeting in Paris (Table 3). As legal structure, a *"Verein" (society) according to Swiss law, domiciled in Zürich and without commercial interests* was chosen for making the Committee independent of governmental or administrative influence and ensure the freedom to handle its affairs in the interest of cryogenic engineering. One of its main aims was to promote the cooperation between research institutes and industry in cryogenics – and the Members were chosen correspondingly.

Table 3 International Cryogenic Engineering Committee

FOUNDED:	18. März 1969 by *Kurt Mendelssohn*, FRS, Clarendon Laboratory, Oxford, and *Keichi Oshima*, Professor, Technichal Physcis, Tokio University
STATUTES:	"Verein" (Society)according to the Swiss Civil Code, domiciled in Zürich, Switzerland, without commercial interests and independent of government institutions
MEMBERS:	maximal 20 specialists elected by the Committee
OBJECT:	To promote the development of cryogenics, above all by holding *International Conferences* at varying places worldwide

The CEC organisers were not outright pleased with this new, internationally aimed competitor in the field of cryogenic engineering conferences. However, ICEC expressed the wish for co-operation and elected two American colleagues as Committee Members. After two years of partly controversial discussion about the most sensible number and schedule of conferences in the field, CEC finally agreed to change from the so far annual to a biennial sequence of their conferences and alternation with the ICEC events. From then on the co-operation was peaceful and satisfying. Members of both committees attended the mutual conferences, and the CEC conferences became a convenient opportunity for the ICE Committee Meetings between ICECs. It is regrettable that the actual situation in world politics led to certain restrictions regarding scientific exchange which in turn have negative effects on the relations between scientists in the USA and in Europe and Asia. One can but hope for fast improvement of the general conditions.

The concept of the InternationaI Cryogenic Engineering Conferences proved to be a good one – after all we have now ICEC 20! For about twenty years the conferences (Table 4) were evenly distributed between Japan and European countries, with a ratio of 1:3. Keichi Oshima's strong engagement should be emphasized here: he organised and chaired three of the first nine conferences, two in Kyoto and one in Kobe, all of them most successful. Meanwhile China and India have become stronger players in the cryogenic community, and other countries are getting nearer to the breakthrough stage. Asia's weight is increasing, and the distribution of conferences between Europe and Asia is changing correspondingly. A look into the Journal CRYOGENICS confirms the healthy growth of cryogenics in Asia: in the first four issues of this year two thirds of the contributions came from there.

Each of the ICEC conferences had its specific highlights and boundary conditions. I will mention here only three examples – ICEC 3 in Berlin, ICEC 13 in Beijing and ICEC 18 in Mumbai – because they mark basic concepts of the ICE Committee's work.

The second ICEC conference in 1968 was rather provisionally organised in Brighton, England, during the preparation phase for the International Committee. When the Committee had been formally

Table 4 International Cryogenic Engineering Conferences

	Year	Place	Local Chairman
ICEC 1	1967	Kyoto, JAPAN	K. Oshima
ICEC 2	1968	Brighton, ENGLAND	A.A. Smailes
• ICEC 3	1970	Berlin, GERMANY	G. Klipping
ICEC 4	1972	Eindhoven, NETHERLANDS	J.W.L. Köhler
ICEC 5	1974	Kyoto, JAPAN	K. Oshima
ICEC 6	1976	Grenoble, FRANCE	A. Lacaze
ICEC 7	1978	London, ENGLAND	J.B. Gardner
ICEC 8	1980	Genova, ITALY	C. Rizzuto
ICEC 9	1982	Kobe, JAPAN	K. Oshima
ICEC 10	1984	Otaniemi, FINLAND	O.V. Lounasmaa
ICEC 11	1986	Berlin, GERMANY	G. Klipping
ICEC 12	1988	Southampton, ENGLAND	R.G. Scurlock
• ICEC 13	1990	Beijing, CHINA	C.S. Hong
ICEC 14	1992	Kiev, UKRAINE	K.A. Yushchenko
ICEC 15	1994	Genova, ITALY	C. Rizzuto
ICEC 16	1996	Kitakyushu, JAPAN	K. Yamafuji
ICEC 17	1998	Bournemouth, ENGLAND	R.G. Scurlock
• ICEC 18	2000	Mumbai, INDIA	K.G. Narayankhedkar
ICEC 19	2002	Grenoble, FRANCE	G. Gistau-Baguer
ICEC 20	2004	Beijing, CHINA	L. Zhang

founded at the Paris Meeting in 1969, one was looking for a suitable place for ICEC 3 in another European country, but none of the Members really volunteered. Rather spontaneously I proposed Berlin as a good place for ICEC 3 and my readiness to organize it. I had assisted Prof. Stranski 1952 with the organisation of the first international symposium in Berlin after the war and had attended two CECs in America, with a certain interest for the organisational aspects. As a born optimist I considered this to be sufficient experience for organising an international conference. However, my suggestion was met with some reservation, especially on Kurt Mendelssohn's side. German activities in international bodies were not yet readily accepted at that time. Moreover, Berlin seemed to be a rather risky place due to its abnormal political situation as a wall-surrounded island in the middle of USSR-inclined East-Germany. And the recent student revolts clouded the picture additionally. However, Stan Safrata, the Czechoslovakian Committee Member, argued that politics and science are different shoes. In science one should not allow the existence of non-accessible "white spots" on the world map, which he emphasized by inviting the Committee for its next Meeting six months later to Prague, just because of the politically uncertain situation in Czechoslovakia at that time, only half a year after the forced end of the Dubček era. His arguments convinced the majority: not only the invitation was accepted (Fig. 11) but also Berlin as place for holding ICEC 3 in May 1970.

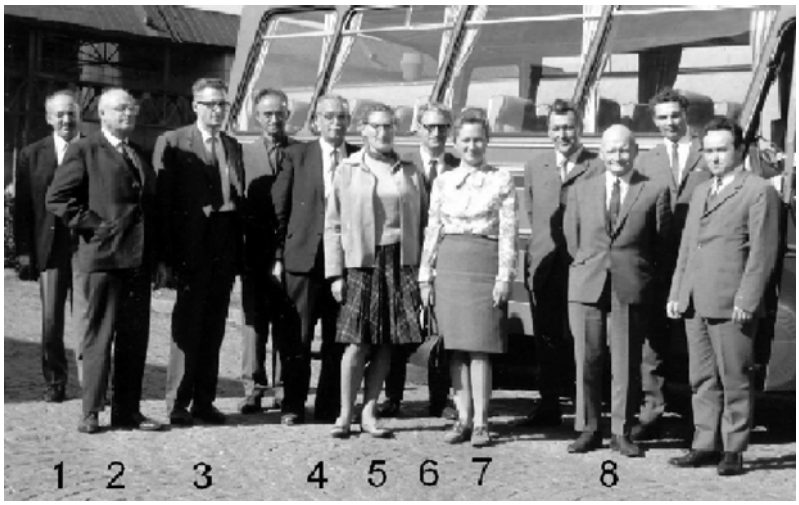

Figure 11 Committee Meeting at Prague in September 1969 (1: G. Klipping, 2: K. Mendelssohn, 3: S. Safrata, 4: J.W.L. Köhler, 5: Mrs. Safrata, 6: J. Olsen, 7: I. Klipping, 8: J.B. Gardner, and Czech colleagues

Experience from the previous two conferences was scarcely available or applicable, and professional conference organisers were still unknown. Locally we had to rely on our own and our collaborators' and students' potential and imagination for the organisational tasks, and all of them did their job with much enthusiasm. The scientific concept was developed in close co-operation with the Members of the ICE Committee. Regarding the practical concept of the event we asked ourselves what we would expect from a well organised and enjoyable conference and did our best to realise this picture. Fortunately, the drawbacks of Berlin's insular situation were politically compensated by ample resources of the city government for attracting international events as a contribution to normality. Thus we obtained considerable financial support for ICEC 3, including an invitation of all 400 participants to a high-class opera performance, Orff's *Carmina Burana*, which became a highlight of these days. This helped a lot to make the conference attractive and a success. At the end we were richer by a host of experiences, and Kurt Mendelssohn, Keichi Oshima and the other Committee Members left Berlin as friends.

In 1980 Chao-sheng Hong (Fig. 12) , Professor and Head of the Academia Sinica's Cryogenic Laboratory in Beijing, the Senior of cryogenics in China, had been elected as Committee Member. Cryogenics in China developed rapidly during the following years, and his proposal to hold ICEC 13 in Beijing in 1990 had been gladly accepted. Quite unexpectedly, some aspects of this conference came to resemble those given in Berlin 20 years before. While the conference preparations were in full swing, the Tiananmen incident occurred, and suddenly economic and scientific interaction with China became a political issue, with negative tendencies in many countries. Their Ministries of Foreign Affairs partly went as far as suggesting to call off all scientific exchange with China. Understandably enough, even in our Committee doubts were voiced if Beijing could and should be kept as conference site. However, we had not forgotten the deciding arguments in the case of ICEC 3 and remained true to our position not to allow politics to interfere with scientific exchange. Beijing remained the place of choice, and ICEC 13 took place at the Fragrant Hill Hotel in April 1990 as planned. It was a well organised, successful and enjoyable event in a beautiful surrounding and a wonderful experience of Chinese hospitality and culture. Even higher powers supported it by surprising the foreign delegates with the spectacle of a sand storm.

Figure 12 Chao-sheng Hong

During the conference Chinese students and younger scientists were eager to discuss with the foreign attendants living and working conditions in western countries, and many of them expressed their interest in working abroad for some time. We had visited China twice before, and it was a pleasure for us that over the years a number of successful co-operations between the Low Temperature Laboratory in Berlin, the Academia Sinica and Chinese universities materialized. Frequently we had guest scientists from China in our laboratory and several Chinese students worked for their doctoral theses in Berlin.

The last of the three conferences to be mentioned is ICEC 18, which was held in Mumbai in February 2000 and had a quite different background. Cryogenics in India, a developing country, had a past history of about 3 decades, which was essentially influenced by a series of long-term Agreements between India and Germany on co-operation in science and technology. Germany became partner country of the Indian Institute of Technology, Madras, one of five high-standard technical universities founded in India in the early 1950es for filling the gap in higher technical education in the country. For many years the development of the IIT Madras was supported with large funds for equipment, personnel exchange and joint research projects. In 1969 it was decided to install a low temperature laboratory at the Department of Physics. I was asked to assist with planning and later also with practical advice and lectures at Madras. This turned out to be the beginning of 30 years of close co-operation with regular mutual visits, training of personnel in Berlin, and joint projects. With growing success the co-operation was extended to other German universities and the Max-Planck-Institute for Solid State Physics.

My counterpart at Madras was Prof. R. Srinivasan (Fig. 13), a theoretical physicist with technical leanings, an outstanding talent for organisation and the gift of conveying enthusiasm to everybody working with him. He made not only the low temperature laboratory at Madras flourish, but also became the motor of the development of cryogenics in India. In due course further cryogenic laboratories came

Figure 14 R. Srinivasan

into being. Among these the Centre for Cryogenic Technology at the Indian Institute of Science, Bangalore, headed by Prof. S. Jacob, and the School of Cryogenics at the Indian Institute of Technology, Mumbai, headed by Prof. K. G. Narayankhedkar, developed particularly well. Another interesting laboratory to be mentioned is the Inter-University Consortium for DAE Facilities IUC-DAEF at Indore, which was founded in the 1980s and was headed during its building phase from nearly zero to a fully equipped, efficiently working low temperature institute by Prof. R. Srinivasan after his retirement from the IIT Madras. As the name indicates, the IUC is a facility open to researchers from all universities in India which otherwise do not have access to low temperatures and the corresponding experimental equipment.

However, in spite of all progress a back-lag in interaction and exchange at international level remained a serious problem for the Indian cryogenic community. For improving the basis for interaction the ICEC Committee elected Prof. Srinivasan in 1985 as Member. When he retired, Prof. Narayankhedkar succeeded him in 1996, and eventually it was decided to hold ICEC 18 in Mumbai at the campus of the IIT Bombay. The conference certainly was a success. Exemplary organisation and the beautiful, tropical surroundings already made it special. In addition, it was highlighted by an impressive social program which showed the participants a variety of facets of the Indian culture. For us this event was a kind of culmination of our long co-operation with Indian colleagues, and we do hope that it has far-reaching effects with regard to the recognition and development of cryogenics inside the country as well as to the improvement of interaction between India and the world-wide cryogenic community. At the present conference a number of Indian colleagues are participating which can be taken as a good sign.

Ingrid and I are both grateful for the chances which my membership in the Committee gave us for actively contributing to the development of cryogenics and international relations within the cryogenic community. Getting to know other cultures and mentalities by working together in scientific or technical projects or in the preparation of conferences is most stimulating and rewarding. It deepens the understanding of each other and friendships develop – far beyond the mere sphere of work.

If one is working in the one and the same field over a long time, it is quite usual that profession and hobby tend to melt into each other. When a couple is working together and sharing not only their private but also their professional interests, this probably holds even more**:** we two certainly have gone “cryogenic” – and we are quite happy with it!