Go West Young Man or how Gisbert came to America

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1 The Black Forest years

A Christmas card from many years ago showed a stylized symmetrical Christmas tree with a little mouse that broke a small piece from one side. Walter Gordy wrote on the card: "This mouse has destroyed the symmetry and broken the parity. Does that make him a physicist?" In Fig. 1 we see a little boy, called Gisbert, trying his skills in remote sensing at the nose of the old farmer Hoferpeter, called Opa (Grandpa). Does that make him an astro-physicist or radio astronomer?

That's me in the background of the picture, sheepishly watching the show, and my sister is holding Opa's right hand. Figure 2 shows the Hoferpeterhof, a four-hundred-year-old Black Forest farm near the village of Bad Peterstal. To the left of the main farm house is a smaller house which my father rented from 1936 to 1946. We kids had the privilege of growing up in this remote setting of an old Black Forest farm and the Hoferpeter family became for us our second family. It was a gift of the heavens, because in 1939 the second world war started, and this remote farm with its fields, meadows and forests provided food, shelter, safety and community during the war years.

2 The Legacy of the RADAR Race

At the time when those pictures were taken, in 1939 and 1940, the Battle of Britain started, a war of life and death. During this precarious time for Britain, the British Prime Minister Winston Churchill and his science advisor Henry Tizard decided to make all military, technological and scientific secrets of the United Kingdom available to the Government of the United States of America in order to solicit help against the menace of the Luftwaffe (German Air Force) and the U-Boats (German submarines). One of the first British magnetrons which produced electromagnetic radiation at a wavelength of 10 cm or a frequency of 3 GHz is shown in Fig. 3. The output power of such

Fig. 1. The old farmer Hoferpeter and the Winnewissers

a magnetron at that time was about 5 to 50 kWatts and with development quickly rose in the pulsed operational mode to 500 kWatts. This particular magnetron tube was perhaps the most valuable cargo ever to cross the Atlantic Ocean [1–3].

In the fall of 1940 all the technical secrets of the U.K., including this magnetron, were collected in a big black box. This box was loaded onto a Canadian ocean liner, the Duchess of Richmond, in the harbor of Liverpool. The ship with her crew, a delegation of British scientists, and a contingent of soldiers planned to leave during a night bombing raid of Liverpool. The Duchess of Richmond left the docks but was forced to anchor just outside the harbor because bombs were falling around the ship. Fortunately none of the warheads struck the boat. In the dawn of the next morning the ship with an escort of mine sweepers and two Royal Navy destroyers left its mooring and reached the open sea. In order to avoid submarines, the ship relied on speed and changing her course every 30 minutes, zig-zagging thus across the Atlantic Ocean to the Candian port city of Halifax. The crew nicknamed the ship 'the drunken Duchess'. The black box with its secrets was brought from Halifax to the British embassy in Washington and kept safe in its wine cellar with the butler as the key man.

After some discussions in Washington between the British scientists, US government officials and Alfred L. Loomis, a Wall street banker and avid scientist, the precious cargo including the magnetron was transported to the

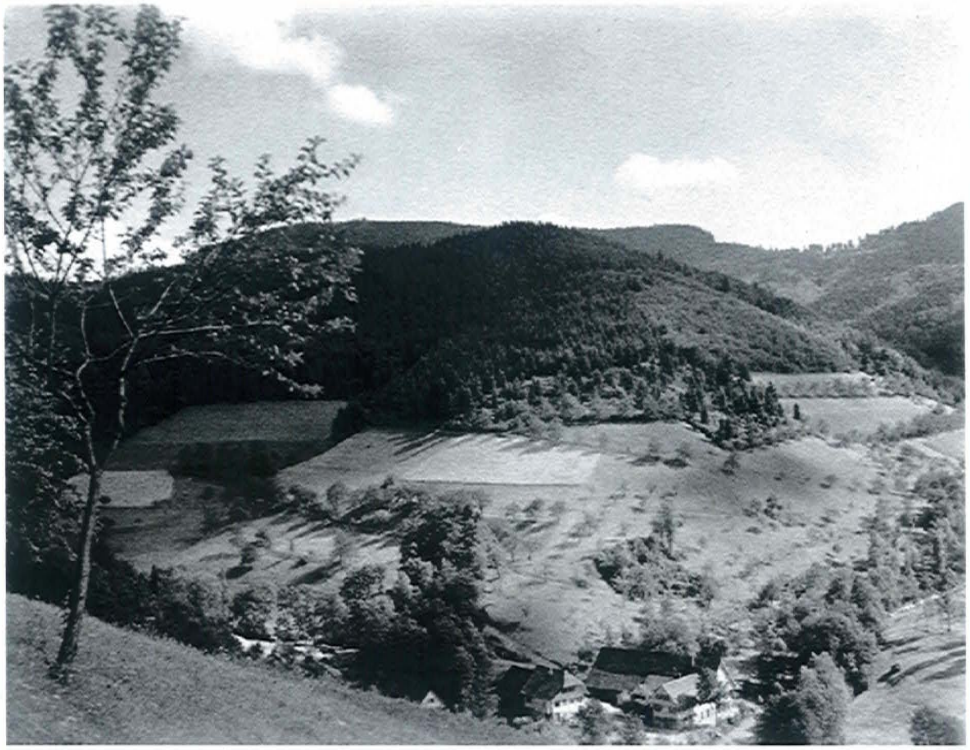

Fig. 2. The Hoferpeterhof neat Bad Peterstal

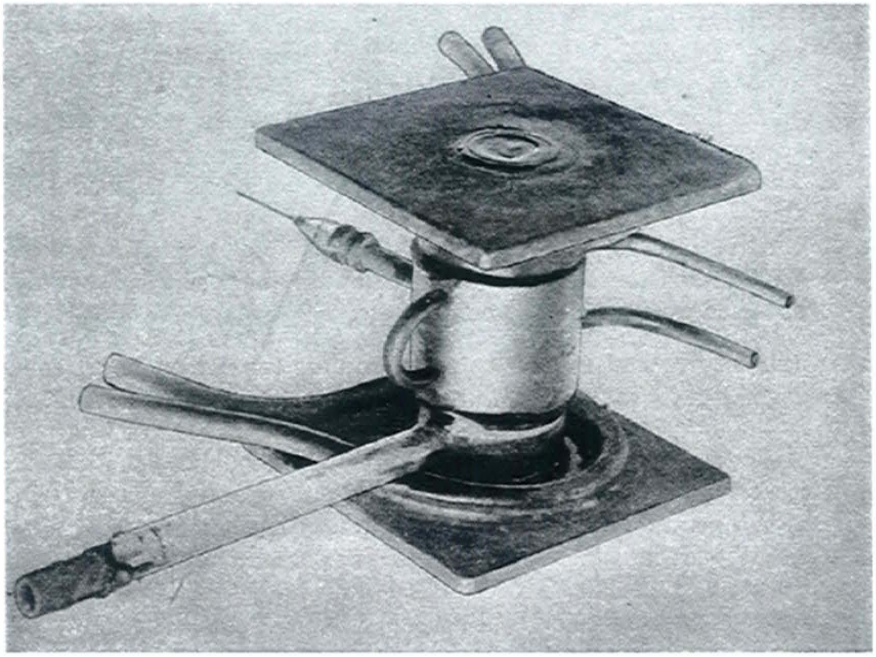

Fig. 3. Microwave Magnetrons, Vol. 6, Ref [4]

secret division of Loomis's private laboratory at the Tower House, in Tuxedo Park in the State of New York. There Loomis wined and dined the British delegation and a select group of American scientists from government, universities and industry. The British scientists unveiled the 10 cm magnetron and explained in detail its operation and expressed their hopes that with

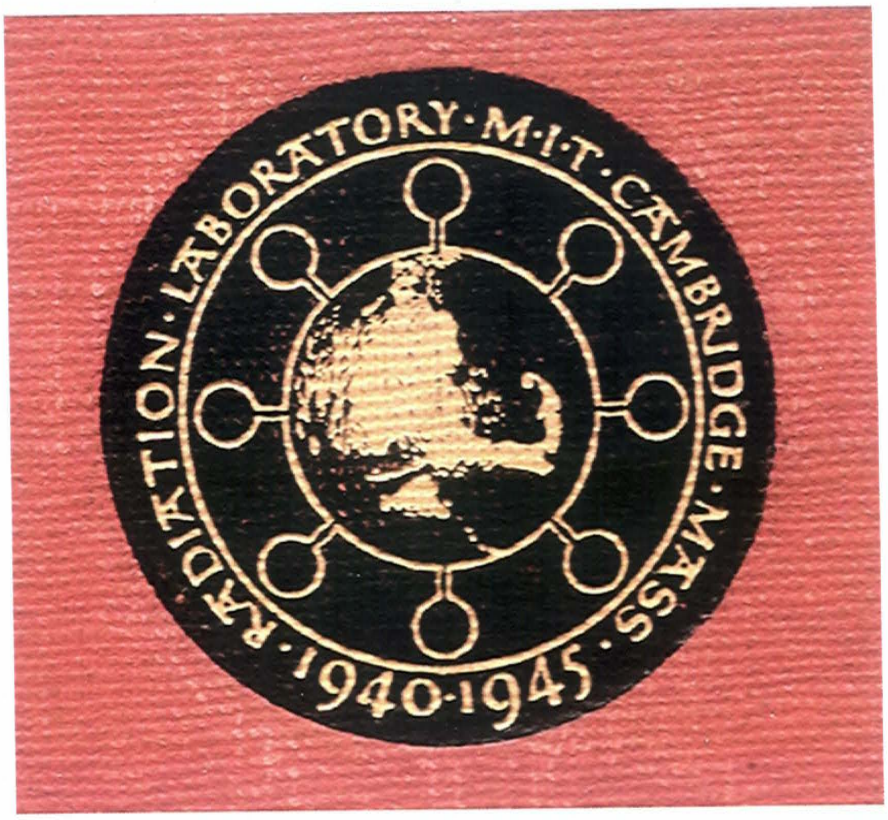

Fig. 4. Seal of the M.I.T. Radiation Laboratory

American help a RADAR system could be developed to reduce the menace of night bombing and to locate submarines via airborne microwave radar. The acronym for radio detection and ranging, RADAR, had been patented by Sir Robert Watson-Watt for meteorological applications in 1935. The magnetron concept, however, was introduced and published in 1928 in Germany.

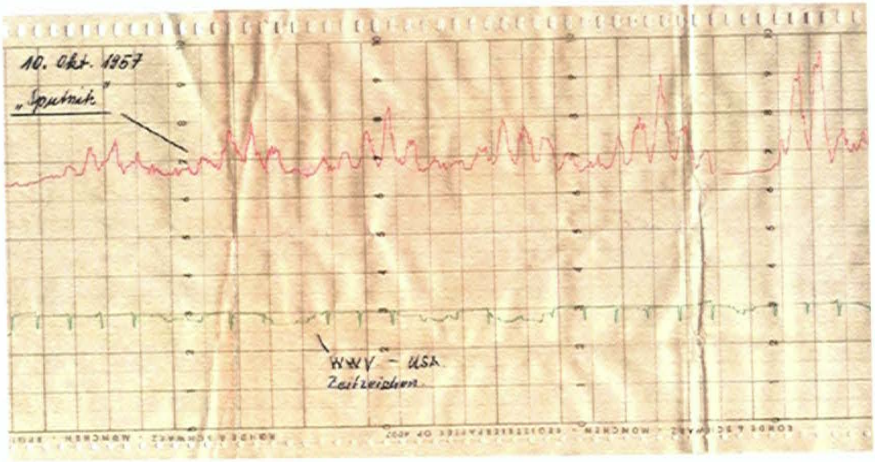

Fig. 5. Top trace Sputnik signal, bottom trace WWV

HONORED AT DUKE LUNCHEON—Four of Duke University's five faculty members who have been elected to membership in the National Academy of Science are pictured above with Duke President Douglas M. Knight, far left, at a commencement luncheon where they were recognized. Each of the five has had a distinguished career and has been given the University's highest rank, that of James B. Duke Professor. Left to right they are: Dr. Walter Gordy, physics; Dr. Knut Schmidt-Nielsen, physiology; Dr. Philip Handler, biochemistry; and Dr. Paul J. Kramer, botany. Dr. Charles R. Hauser, whose field is organic chemistry, was unable to attend the luncheon. With the election of Drs. Gordy and Handler this spring, Duke now has more NAS members than any other institution in the Southeast. Only the University of Texas, which has six, exceeds Duke among institutions in the entire South. —Duke Photo.

Fig. 6. Dr. Gordy second from left became a member of the National Academy of Sciences in 1963

The Bell Laboratories were asked to duplicate the British 10 cm magnetron. The Bell people X-rayed the magnetron and found to their consternation eight resonator cavities instead of six, the number shown in British engineering plans. A heated discussion took place between the British engineers, the US government people and the Bell Laboratory representatives. The British scientists could not explain this discrepancy. They had to call England in order to find out that a technician had selected the best-performing tube and neglected to note that this particular specimen alone possessed eight resonator cavities. Figure 4 displays the Seal of the Radiation Laboratory, M.I.T. Cambridge, Mass. 1940 - 1945, with the eight resonator cavities indicated and a RADAR picture of the coast of Massachusetts in the center. In October of 1940, the Massachusetts Institute of Technology was chosen to house this independent laboratory that would be staffed by civilian and academic engineers and scientists from every discipline. During the heyday of its activities the Radiation Laboratory employed nearly 4000 people, among them young Dr. Walter Gordy (1909 - 1985), who worked on the radar project

from 1942 to 1945. In February of 1946 he joined the Physics Department of Duke University in Durham, North Carolina bringing lots of government surplus equipment and lots of ideas about how to apply microwave techniques to the study of molecular rotational spectra and molecular structure. Thus the Duke Microwave Laboratory was born.

3 The Years at the Technical University Karlsruhe

While we were growing up in the Black Forest we had, of course, no idea what was going on internationally except that the war was getting more and more difficult for the German and European population. On 7th of December 1941 Japan attacked Pearl Harbor and four days later the German government under Adolf Hitler declared war on the United States of America. I will never forget that day, because we were listening to the news on a Volksempfaenger (people's receiver, only one station) and my mother came from the kitchen into the living room rather pale and said: "This war is lost". She knew the United States because she worked as a governess from 1922 to 1927 in New York City. In January of 1942 our father was killed in action on the Eastern front near Moscow.

Many years passed and Gisbert began to study physics while I, the older brother, studied chemistry at the Technical University in Karlsruhe. After completing all the requirements for a masters thesis in chemistry I went to the Physical Chemistry Institute of the Technical University, in particular to a dynamic young lecturer, Werner Zeil, to obtain a laboratory place. I knocked on his laboratory door. I heard a noise, but could not decode what it meant. So I opened the door. The first thing I noticed was a big electronic rack with lots of tubes, transformers and condensers, and Dr. Zeil sitting awkwardly on the floor in the opposite corner of the room. I asked him, quite inexcusably, if he was building an accelerator. He was not amused and answered: "If you want to work for me you have to fix this klystron power supply first", which I did. At that time, of course, I had no idea what a klystron was. As a matter of fact, I wasn't officially supposed to know: all experimental research related to radar technology was at that time forbidden in Germany by the Allied Control Council.

In October 1957 the Russians launched the first artificial satellite orbiting the Earth, called Sputnik. We realized that the signals of Sputnik could be detected at 20 MHz with the electronic gear which we had already assembled in the Physical Chemistry Institute towards the construction of a microwave spectrometer. Figure 5 shows a chart recorder trace of our historic record of the signal of Sputnik (top) and below are the one-second pulses of the time standard of the United States, WWV.

About two weeks later an American officer came to the institute to inform Dr. Zeil that from now on all Allied restrictions on microwave work were lifted and U.S. Army surplus electronic equipment will become available. It

Fig. 7. Gisbert makes his first multiplier contact

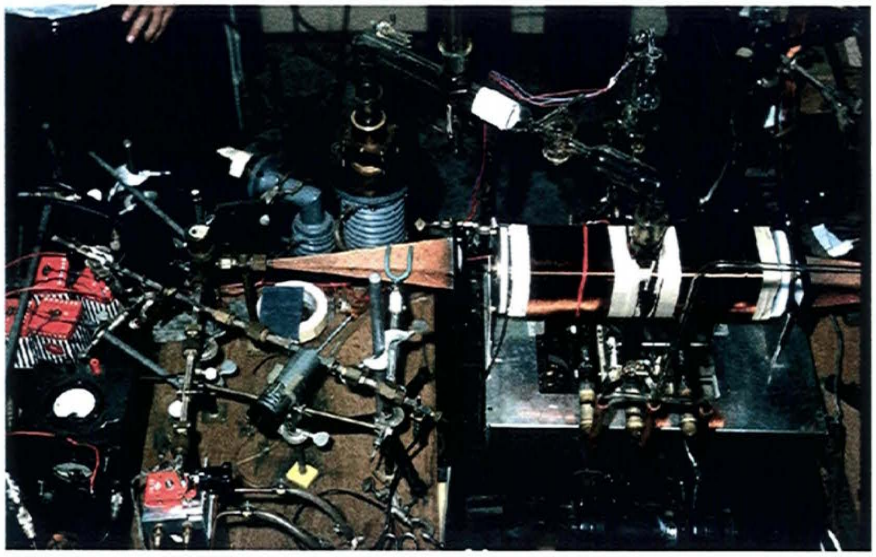

Fig. 8. Millimeter Wave Spectrometer 1963/1964

was only then that Dr. Zeil told us that the one klystron he had was smuggled into Germany from Copenhagen. The Raytheon 2K33 klystron had been given to him by Professor Borge Bak of the University of Copenhagen.

Dr. Zeil instructed me as a graduate student to design and build a frequency standard. My colleague and friend Hans-Karl Bodenseh and I had to design and build an entire microwave spectrometer. This was, of course, a major effort for two chemistry students who had so far enjoyed a classical synthetic organic and inorganic education. It helped, admittedly, that I had been an electrician's apprentice at one time. Well, we checked the literature and came across the Massachusetts Institute of Technology Radiation Laboratory

Series of 28 volumes [4]. These volumes contain the advances of knowledge and the technological progress made by the scientists of the M.I.T. Radiation Laboratory during the war years in the fields of microwave electronics and RADAR sounding. Vannevar Bush, the Director of the National Defense Research Committee of the United States, wrote in his introduction to the M.I.T. Series: "Julius Caesar recorded for us not modestly, but with revealing detail, the story of his Gallic conquests. ... World War II brought with it the responsibility for a new kind of documentation. Technological progress in weapons and devices of warfare was of such transcendent importance that it influenced the turn of events at almost every point".

We were overwhelmed by the amount of high frequency physics and technology we had to study and learn. The first book from this series I studied was Montgomery, "Technique of Microwave Measurements", where I learned about wave guide modes, klystron modes etc. I signed up for a course in high frequency physics to help meet this challenge.

Once in a while Gisbert came to the laboratory to see what his chemistry brother was doing: microwave electronics! Among our fellow chemistry students we were considered an exotic species: a real chemist does not do such things. However, our education did not stop there. Four more books had to be studied in detail: the first one was Walter Gordy's [5] book on Microwave Spectroscopy, the second one was Townes and Shawlow's [6] book on the same subject. Then we discovered that we had to learn quantum mechanics with application to molecular systems and, simply, molecular spectroscopy. Therefore I would like to mention the book by Pauling and Wilson [7] on quantum mechanics and G. Herzberg's [8] famous series of books on molecular spectroscopy. Despite the enormity of the work it was an exciting time and it was fun!

4 The Years at Duke University, Durham, N. C.

When I got my Ph.D. I decided to write to the authors of three of the books I have mentioned: Walter Gordy, Duke University, Charles Townes, Columbia University, and E. Bright Wilson, Harvard University, representing the three most prominent microwave laboratories in the U.S. Walter Gordy answered first with a firm offer of a postdoctoral position, Charles Townes never answered, and E. Bright Wilson wrote and said, "I will be at a European Conference this summer, there we can meet". I made a fast decision and accepted Walter Gordy's offer. Thus, I joined the Microwave Group at Duke University in the fall of 1961.

In the spring of 1963 Dr. Gordy received the honor of being elected a member of the National Academy of Sciences, as reported in Fig. 6. We were all proud of him and I was very happy that I had come to Durham. Meanwhile, back in Karlsruhe at the Technical University, Gisbert had received his Masters degree in physics, but was not inspired by the teaching and research

situation at that time. It must be remembered that most of Germany's former good physicists were then in the U.S. or elsewhere.

A good friend of mine, Roger Kewley, a postdoctoral fellow in the Duke Microwave Laboratory from England, married a young lady from Tennessee. The wedding reception was held at the Carolina Inn in Chapel Hill. Somebody asked me if I had any siblings. Yes, I said, I have a younger brother and a sister, and Gisbert would like to come over here. I was planning to contact Professor Eugene Merzbacher, a theoretical physicist at the University of North Carolina at Chapel Hill with whom I thought Gisbert would like to work, since Gisbert had a strong mathematical ability and training. Well, Dr. Gordy overheard this conversation. Two weeks later I received an airmail letter from Gisbert. To his surprise Gordy had offered him a research fellowship and would take him on as a graduate student towards a Ph.D. I went to Dr. Gordy's office and asked him about his offer to Gisbert. He looked at me, smiled and said with his Mississippi drawl: "If your brother is only half as smart as you, I will try to get him first". I immediately wrote back to Gisbert and told him: "Forget everything, go West young man, and come".

In the fall of 1963 Gisbert arrived in Durham, N.C. In those early days in Durham Gisbert was very critical of America. I give two examples of why this was somewhat understandable: First, every Ph.D. candidate had to pass an examination in two foreign languages. For a native English speaking student they were usually French and German. Now Gisbert was a native German-speaking student, which meant he had to take French and English. He passed the French test all right but failed the English exam. He was of course extremely unhappy and went to Dr. Gordy to complain bitterly. Dr. Gordy called the Dean, the Dean called the administration who called the English department and they told him, look we mixed up the test papers and since his English is actually good, the simplest thing would be if your student could repeat the test. Indeed, Gisbert took the English proficiency test once more and passed.

Then as time went by, the qualifier exams came up, a prerequisite for the Ph.D. Gisbert and I were living together at that time. He told me that he knows all the material, including Maxwell's equations and their applications to waveguide and resonator cavities. After all, he had his Diplom, his German Masters Degree. I reminded him that Dr. Gordy would surely ask about Maxwell's equations and their consequences. Well, Gisbert passed conditionally. He was required to take the graduate electricity and magnetism course, which he naturally passed.

Gisbert was now a Ph.D. student and started his research work. It began with pointing cat whiskers (sharpening tungsten wires) and making multiplier contacts for frequency multiplication from the microwave range into the millimeter wavelength range, and similarly the necessary detector contacts in order to observe the absorption signal on the oscilloscope as can be seen in Fig. 7. During these long sessions of pointing cat whiskers and learning how to make good contacts we listened to commercials on the radio. I still remember

one suitable commercial from a funeral home: "You can have a Cadillac or Chevrolet funeral depending on your means... Come and visit us... Our morticians will show to you what they can do for you. The final touch, it means so much". Every time we made a multiplier or a detector contact we quoted this punch line. The final touch, it means so much: Because an infinitesimal change in the contact pressure was either life or death for the signal!

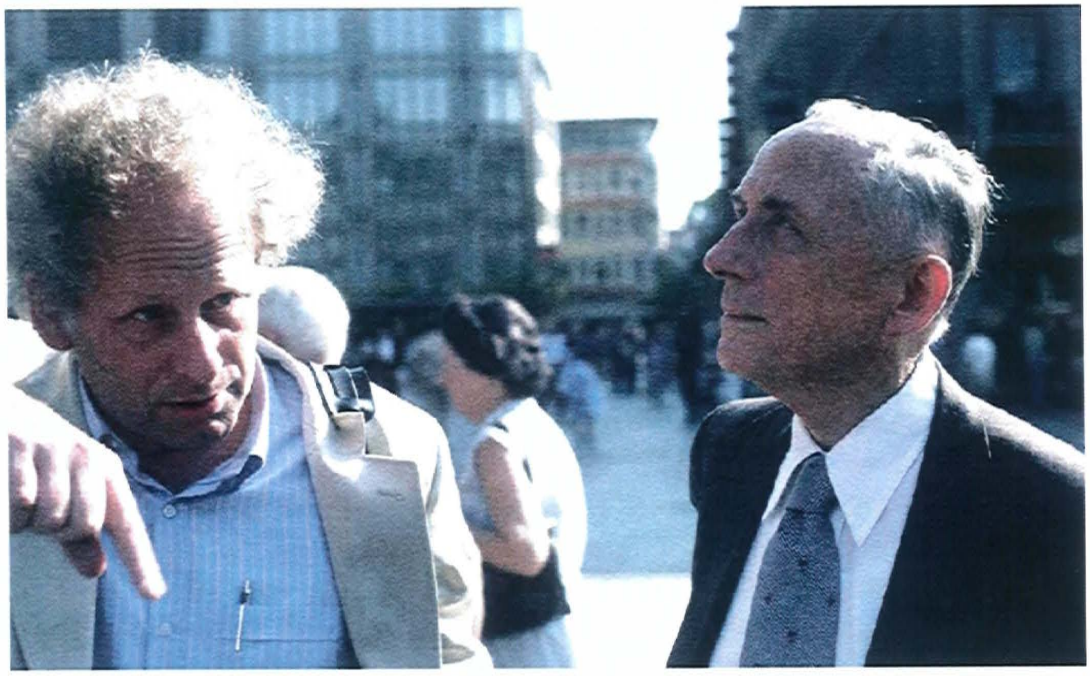

Fig. 9. Gisbert and Walter Gordy in Cologne 1983

Gisbert joined me in a search for the spectrum of the SH radical. A few candidate lines were found with the spectrometer shown in Fig. 8. The molecules whose absorption lines we were observing were produced in a radio frequency discharge located below the absorption cell. The millimeter wave radiation traversed the cell from the multiplier on the left to the detector. But it turned out that the carrier of these lines was not SH but the molecule HSSH. After this fact was established, the millimeter wave spectrometer was completely redesigned and rebuilt and we learned how to chemically synthesize HSSH.

Gisbert was now embarked on his beautiful Ph.D. research work and after that, couldn't be stopped. His scientific career brought him from the Duke Microwave Laboratory of Walter Gordy to the National Research Council of Canada, the University of British Columbia, the Max Planck Institute of Radio Astronomy in Bonn and finally to the University of Cologne and the Gornergrat (Zermatt).

5 From "Time Was" to "Time Yet"

Walter Gordy was not only a research director to us — Gisbert, Brenda and myself — he also was a fatherly friend and advised us in many critical situations. Therefore we remember him and Mrs. Gordy with great pleasure and gratitude: Dr. Gordy for his infectious enthusiasm for physics and science and for his basic wisdom and fairness and Mrs. Gordy for her kindness and hospitality as well as help in correcting the English of many papers and theses. The years at Duke University were the golden years of our youth. In 1983 Dr. and Mrs. Gordy visited Gisbert at the University of Cologne, the occasion of the last picture we have of Dr. Gordy, shown in Fig. 9. He passed away in 1985.

Well, Gisbert, I will conclude with the message of the last Christmas card Brenda and I received from Dr. and Mrs. Gordy showing the space-time coordinates of a Christmas Tree (Fig. 10): "Time Was" shows some dead branches on the ground, "Time Is" shows a woodpecker in action and "Time Yet" shows still green branches with Christmas ornaments. Gisbert, we wish you lots of green branches and scientific gifts in the "Time Yet" regime.

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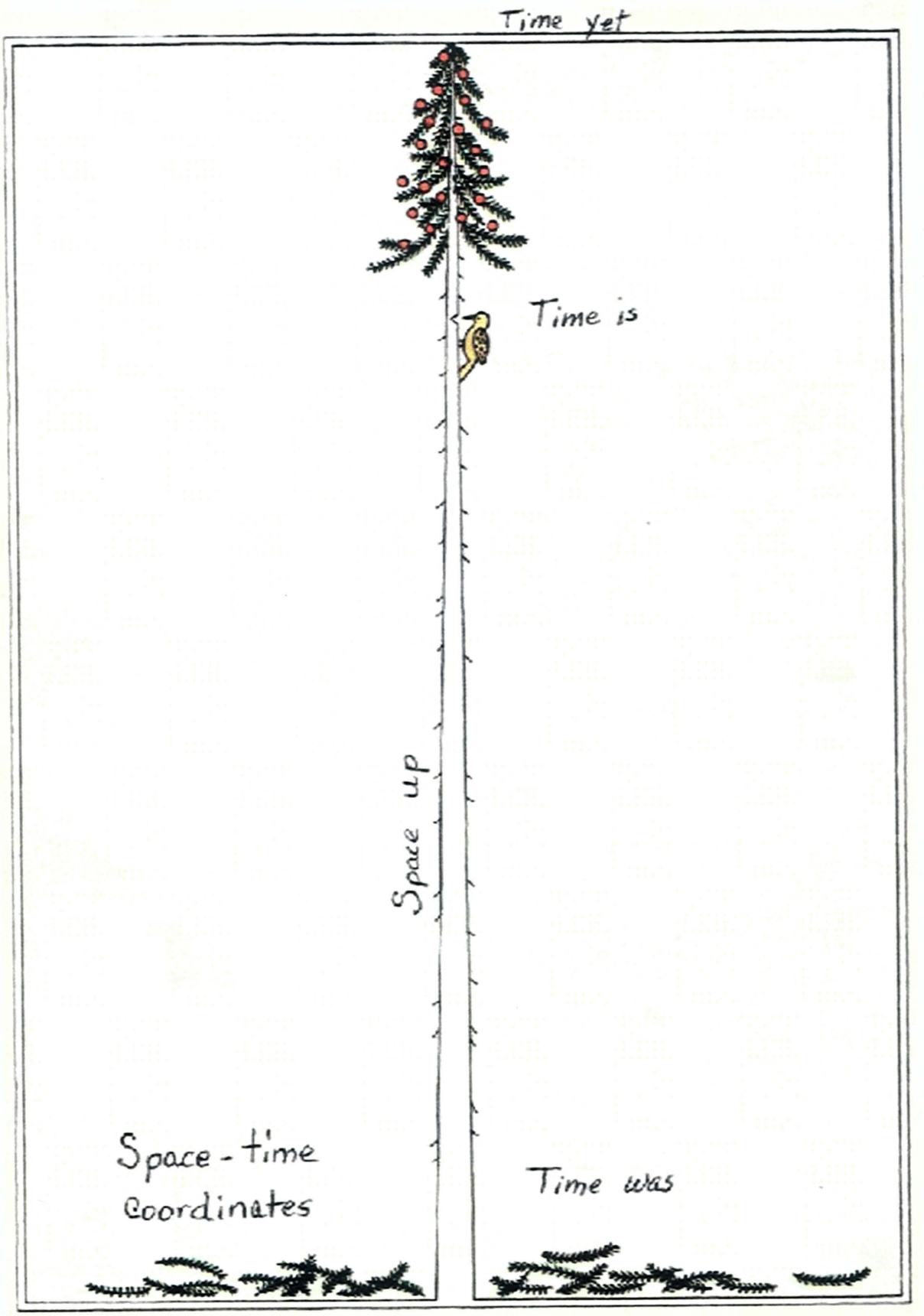

Fig. 10. Last Christmas Card from the Gordys