

Chapter 2

Rolf Hagedorn: The Years Leading to T_H

Torleif Ericson

Abstract On the occasion of Rolf Hagedorn's 75th birthday it gives me a special honor and pleasure to have this opportunity to add these remarks about the seminal influence Hagedorn has had on the scientific community.

2.1 CERN Theory Division in 1960s

Having been friends and office neighbors at CERN for more than 35 years (Fig. 2.1) I want here to recall the atmosphere at CERN when I first met Hagedorn in 1960 and some episodes that I remember from our time together at CERN. I will also say a few words about the miraculous events that brought Rolf Hagedorn into physics in the first place, and soon after to CERN.

Rolf Hagedorn brings to my mind a particular word: fortuitous. The word 'fortuitous' has several meanings. First of all fortuitous means something that happens by chance, it's statistical, and the word statistical of course brings Rolf Hagedorn to mind immediately. But fortuitous has also the overtone of something of good fortune, good luck, and that again is very much what I associate with Rolf's impact on all of us. It also applies very much to his path into science and choice of research area, which has also been associated with a couple of steps of chance and good fortune.

I first met Hagedorn, when I arrived at CERN as a postdoc in 1960. CERN was a quite different place at the time, not at all like CERN today. It was considerably smaller, although Rolf probably would say it had already become a very large organization before and during the time he was there. But in 1960, when I came

Adapted from: *Hot Hadronic Matter: Theory and Experiment*, NATO ASI Series B: Physics Vol 346, Jean Letessier, Hans. H. Gutbrod and Johann Rafelski, Plenum Press (New York 1995).
With kind permission of © Plenum Press, New York, 1995.

T. Ericson (✉)
CERN-TH, 1211 Geneve 23, Switzerland



Fig. 2.1 Torleif Ericson (*left*) and Rolf Hagedorn listen to an after dinner lecture. Across the table Tatjana Fabergé is onlooking. *CREDIT: CERN Photo 1994-06-067-031*

to CERN, the Theory Division had only some 30 people or so and now we are 170. So everybody knew everybody and we discussed our research with everybody else.

I had the good fortune to be assigned an office next door to Rolf's, and luckily, fortuitously, even in later years we have always had offices side by side, so we have been in very close contact. I had been working myself on statistical reactions in nuclear physics, and in particular on compound nuclei and related topics, and it was of course interesting to see what this could mean in particle physics. I knew before I arrived about Hagedorn, at least vaguely.

Once at CERN I quickly wanted to know what Rolf Hagedorn was up to. I immediately found out that he was a true strong interaction man—I recall that when I first went to his office, I did not look at his door. I just knocked and stepped in—ignoring a huge sign on the door saying 'Ne pas déranger'—'Do not disturb'! I did not know that Rolf had the habit of taking a nap for an hour or so at noon, and I just barged in there. As you can imagine, there was a pretty strong interaction! I was a newly arrived, fresh postdoc, while he was a staff member fast asleep. But ever since I only had very pleasant interactions with Rolf.

What was the Theory Division at this time? Let us look at the people who were around. Many of these friends came to celebrate Hagedorn's 75th birthday. There was one important fixture of the Theory Division through all the years, our beloved Tatiana Fabergé, see Fig. 1.4. She was already then running the TH-division, and has done it ever since, independent of whoever happened to be the division leader.

The late Léon Van Hove came to take up the leadership of the Theory Division on nearly the same day I arrived and he was already a major physics figure. He had been on and off at CERN before, but that was about the time he started to take care of us. He is unfortunately no longer with us, but his wife Jenny is here. I am very happy about that, since Léon was a very old and dear friend of Rolf's.

Jacques Prentki was member of the division from the early days. John and Mary Bell had arrived at CERN about a year before—Mary was not part of the Theory Division, but was in close contact with it. Since Hagedorn also was interested in accelerators, the Bells were also in close contact with him. André Martin had shown up the year before and was like me a fellow in the Theory Division as was Daniele Amati. Both became staff members a couple of years later. Roland Omnès had left just before I arrived, as did Frans Cerulus who had interacted very strongly with Rolf. André Petermann was busy with calculating QED corrections.

Another staff member was the late Vladimir Glaser, who was a very brilliant abstract theoretician, who had been earlier a postdoc along with Rolf in Germany. He was a staff member for many years and a great specialist in finding ingenious counter-examples to theoretical conjectures. That covers the staff members, and most of the remainder were fellows, with a few visitors from the USA. It was really quite a small group, very different from the 170 postdocs and senior people who are in the group today.

2.2 Hagedorn's Path to and at CERN

The War Years

Let me now tell a few words about the scientific career of Rolf Hagedorn (Fig. 2.2), and about how he got into physics in the first place. This is a very interesting story, which I have heard from Rolf Hagedorn in various forms at various times throughout the years. Until rather late in his life there was little that indicated that Rolf would make an exceptional career as a scientist.

Hagedorn's life as a young man was deeply marked by the upheavals of the war years in Europe and the greater evils that took place at that time. He graduated from high school not long before the war, was immediately drafted into the army, and soon after the WWII started shipped off into North Africa as an officer in the Rommel Afrika Korps. He has told me how much he enjoyed the vast spaces and the quiet, pitch dark nights with brilliant stars in the desert.

As you know the Afrika Korps was captured following the Allied invasion of North Africa in 1943 and Rolf spent the rest of the war in an officer prison camp in the United States. They were all very young people in the camp and there was not much to do, so they set up their own 'university'. There were of course no senior professors, so these young men taught each other what they happened to know. Presumably this was similar to Viki Weisskopf's saying: 'Physicists are persons who explain to each other what they do not know'. So maybe that was when Rolf Hagedorn became a physicist. At first he got training not so much in physics, but in other subjects such as mathematics, since he met an assistant of Hilbert's, who knew a lot of mathematics.

Fig. 2.2 In midst of the experimental advances in heavy ion physics, Summer 1994, a workshop on “Hot Hadronic Matter: Theory and Experiment” was held at Divonne, France. The proceedings were published as: *Hot Hadronic Matter: Theory and Experiment*, NATO ASI Series B: Physics Vol 346, Jean Letessier, Hans. H. Gutbrod and Johann Rafelski, Plenum Press (New York 1995). The picture shows Rolf Hagedorn, on June 30, 1994 thanking those attending. *CREDIT: CERN Photo 1994-06-065-004*



At Göttingen

When Hagedorn returned to Germany in January 1946, German universities had been destroyed. In fact the students usually had to start at the universities literally carrying bricks to build up the institutes. Rolf in his mid-late-twenties following nearly 9 years of service, war and prison camp was not a very young student. Because of his training in the prison camp he succeeded, after some non-trivial effort, to be accepted as a fourth semester student at the university of Göttingen—one of the few left standing and at the same time a university with a great tradition in physics and mathematics. After having completed his studies with the usual diploma and doctorate with a thesis under Richard Becker on solid-state physics, he was accepted at the Max Planck Institute for Physics as a postdoc.

This was still located at Göttingen at the time, and not yet in Munich, and the director was Werner Heisenberg. Hagedorn was a member of an exceptional group and I think some names might interest you: Bruno Zumino, Harry Lehmann, Wolfhart Zimmermann, Kurt Symanzik, Gerhard Lüders, Reinhard Oehme, Vladimir Glaser, Carl Friedrich von Weizsäcker and a couple more. I suppose at the time Hagedorn thought that this was a pretty normal group, but there

was something very special at Göttingen at that time, for all of them have made important marks on physics in the following years.

In 1954 Hagedorn got the opportunity to go for some months to CERN, this very new place coming up in Geneva, which was not yet well known, and in fact not even formally and totally approved. He arrived at CERN to help with accelerator design problems, to calculate non-linear oscillations in particle orbits. The pioneering work on linear orbit theory had just been completed by Gerhard Lüders, who wished to go back to Göttingen.

Lüders asked Heisenberg to send somebody to replace him, and Heisenberg asked Rolf if he was interested in going for a couple of months. Being paid only 300 DM per month at the Max Planck Institute (not much for a family of three) Hagedorn jumped at the occasion. Important events in life happen like that: you come for a couple of months but you end up staying for the rest of your life. That's exactly what happened to Rolf.

At CERN

During this early period Hagedorn calculated non-linear orbital oscillations of the CERN-PS with some clever novel approximation techniques extended from one dimension to two dimensions. When the CERN theory group came to Geneva from Copenhagen, where it had been located at first, Rolf joined it, and it was how we met in 1960. In the small CERN environment of the time, it was easy to move between very varied activities and he had of course been a theoretical physicist all the time.

I want to emphasize that it is this unusual background that has marked Rolf deeply in his scientific evolution; a Ph.D. in theoretical solid state physics, followed by work on cosmic ray interaction in Heisenberg's institute, on to orbit theory at CERN and finally, to the CERN theoretical physics division, he has seen most of the physics of the day. Without such a varied experience he may have had a very different and probably less original impact on physics.

In these early years I had many discussions with Hagedorn about statistical hadronic physics and its basis, but I never quite got into the field. He explained to me repeatedly the background of the Fermi statistical model and its assumptions. I always thought I understood it, when he explained it, but afterwards I never completely understood it. I do not know today if I understood it or did not; it was on and off.

While I did not quite personally get involved into Hagedorn's research line, I followed it closely. I speculated if the kind of statistical fluctuations effects I worked on in low energy nuclear physics could be applied to these high energy situations. Steve Frautschi developed some of these ideas later on. I instead turned to intermediate energy physics, which took off just then.

One day, which I remember vividly, some time in late 1964, I encountered Hagedorn who was just bubbling over to a degree I have never seen before or since. His eyes were quite bright describing to me all these fireballs: fireballs going into

fireballs living on fireballs forever and all in a logically consistent way. This must have been only a few days after the invention of the statistical bootstrap picture. I had the impression of a man who had just found the famous philosopher's stone, and that must have been how Hagedorn felt about it. Clearly, he recognized the importance of his novel idea.

2.3 Appreciation

We all know that Rolf Hagedorn was not a physicist who shot from the hip in face of a new problem. He took his time; he worked it over; he wanted to absorb it. Maybe this reflects the thoughts of long nights in the desert and the prison camp, in which time of reflection is a great virtue. I am sure that this pattern was a mark of this background, being brought up in an environment with plenty of time for informal discussions, with few formal classes pounding down your neck and professors pushing you to produce something very quickly. As result you learn to absorb a problem slowly, and, in case of Hagedorn, you do it profoundly.

Maybe that is why, in a strange way, Hagedorn differed from a large number of other prominent physicists I have met during my life. Most of the physicists are recognized rapidly after their contribution. After that quick recognition, their impact as time goes on gets disseminated and integrated, and people often notice it less and less. With Hagedorn, the opposite happened. It is like the best of wines. It is not so palatable in the early years, but as time goes on, it becomes more and more remarkable.

Statistical Bootstrap was looked upon with considerable skepticism in the beginning, at least within the CERN Theory Division. But as time has gone on, it has taken on bigger and bigger dimensions and has become more and more important. This is the sign of truly original work, of something that had real influence on our thinking.

Open Access This book is distributed under the terms of the Creative Commons Attribution Non-commercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author(s) and sources are credited.