

An Oral History of

## HANS SUESS and KAREN FLECKENSTEIN

On October 24, 1984

1 **SUESS:** I get interested in the dimensions of the elements. Well, that goes back—way back—  
2 to the time when I was a student, in a way. I didn't work on this in my thesis, but I did do some  
3 experiments with heavy water during the time of my thesis in Vienna. And then, my father [Franz  
4 Eduard Suess] was a geologist in Vienna—professor of geology—and I just didn't get interested  
5 in his problems. I found them not enough fundamental he was working on.

6 But, on the structural geology origin of my continents. By the way, he was a believer and he was  
7 a strong support of making this continental drift, and that was at the time when continental  
8 drift—. You've heard of that—

9 **FLECKENSTEIN:** Hm-hmm. Oh, yeah.

10 **SUESS:** —was completely out-moded, and everybody who did things like that was a crack  
11 pot. And my father was very upset. He said, "You can see with your eyes. You don't have to  
12 know anything"—that not only the geology of the continent fits together, it was also the  
13 mountain ranges—the way mountains were folded and then torn aside and built up again. That's  
14 obvious that this means that the continents were moving.

15 And he was very dissatisfied, at this time, with not having anything to do with—nobody believed  
16 in this crackpot hypothesis. It takes 30 or 40 years before an argument and theory, and  
17 whatever you will call it, is accepted. Very often, the whole basic global geology was on the  
18 wrong track, and all of a sudden, due to your physics and oceanography and what not. Long  
19 after my dad had died, we're all of a sudden, agreeing with him. There were a few people who  
20 believed in what he said and also, he found some people to support this.

21 So, I was not trying to get involved in these questions. I was a little interested in whatever you  
22 can do as a chemist to support this and one thing was the origin of tektites, and got a little  
23 involved in what was flying around in outer space. And so, before I did anything else, I was  
24 interested in looking at physics, looking at chemistry. And when I got to Hamburg in 1937, it was  
25 about three years—two years after I got my Ph.D. I spent a year in Switzerland. There was no  
26 job. There was no job at all.

[Break in audio]

27 **SUESS:** Okay. So, in those years after my Ph.D., I spent a year in Switzerland. Well, the  
28 Swiss—you can't get a permit to work there. I was registered— I was enrolled as a student. That  
29 was the only way I could spend a year in Switzerland.

30 And then, I was back in Vienna, and was just completely hopeless to get a job. In Switzerland,  
31 they said, "What do you want here? We have so many refugees from Nazi Germany and you  
32 don't have any reason to leave your country, Austria." And I say, "What should I do there?  
33 There's no possibility to earn any money."

34 So, I did— Herman Menkel [?] was the director of this institute. He asked me, "Are you having  
35 any problems working in Germany? Because I can get you a job with Germany." So, I said, "I  
36 don't think so. It will be all right."

37 So, he sent me to some universities in Germany. Well, finally—I don't want to talk too much  
38 about myself, but finally, an Austrian [Paul Karl Maria Harteck] from an old Vienna family  
39 Harteck—actually, his originally was Nartekczech [?], but his name that he used was Harteck,  
40 He just had spent a year in England in the Cavendish working with—well, I have problems  
41 remembering names. But then, he went back because they offered him the position with Otto  
42 Stern in Hamburg, which he gladly accepted, although, he was reluctant to work in Germany.  
43 And then, he came to Vienna because that was his hometown and I told him what problems I  
44 had.

45 And it just so happened that my grandfather, Eduard Suess—. Suess is a Jewish name,  
46 actually, so, got to be careful but, in my case, the name Suess came from old Protestant  
47 preacher family. But the father of my grandfather was tutoring the children—the boys of a rich  
48 banker in Prague, and he also had a daughter. And my great-grandfather [Adolph Suess] fell in  
49 love with his daughter [Eleonore Zdekauer], and that was a Jewish family. So, he married this  
50 daughter of this banker and then, they sent him to Spain before they allowed him to marry  
51 because she was only 17.

52 And then, finally, he ended up—after having married, he ended up in London, and my  
53 grandfather was born in London, together with some brothers and sisters. And then, they got  
54 back to Vienna. And I think what my grandfather's ideas were—. They wanted him to become a  
55 businessman, of course. The father-in-law was a banker and the father—his own father was a

56 minister—a Protestant minister. So, he was supposed to— Yeah, that was one condition that he  
57 was allowed to marry the daughter of this banker—was to give up his theology. So, he didn't  
58 mind too much. Also, he had been preaching in Prague for a year or so. But he was still  
59 interested in what's true with the bible and what we really knew about the origin of the earth and  
60 the way—what was in the past, on the surface of the Earth. So, that was just about the time  
61 when—well, [Charles] Darwin was a little later, but this was about the same time. And, of  
62 course, when Darwin—Charles Darwin published his Origin of the species [*On the Origin of*  
63 *Species*], he was very enthusiastic about it. And my grandfather wrote this book, *The Face of*  
64 *the Earth* [*Das Antlitz der Erde*], which deals with quoting the bible and then saying what it will  
65 happen and what we know about the delusion, what theologically could have happened.

66 **FLECKENSTEIN:** Was that in England?

67 **SUESS:** That was—no. That was already when he was back. First, he came to Vienna and he  
68 got a job as a—in the meteorite collection. The director of the collection was a bachelor. But he  
69 had three daughters and one of them my grandfather married. That's my grandmother [Hermine  
70 Strauss].

71 And he worked as a mineralogist for a while, but then, he started working on geology. And then  
72 he became, eventually, the head of the liberal party in Vienna [Sozialdemokratische  
73 Arbeiterpartei Österreichs (SDAPÖ)]. Well, he was a scientist and most of what he did was  
74 geological science and wrote the bible, so to speak, in geology. But also, he became a member  
75 of parliament and the head of the Austrian Academy [of Sciences]. And he was fighting— I don't  
76 know if you mind, but that was real. I think the big achievements, my grandfather, were in the  
77 field of geology.

78 But also, he was a well-known politician with fighting the school—the Austrian school system,  
79 which demanded the Catholic views to be the official ones and the others were not. There was  
80 school reform and there was a reactionary time when—it was pretty close to getting as bad as it  
81 was in Tennessee 50 years ago—when my grandfather lived. He was very successful in  
82 preventing these [*inaudible*]. And so, that was—. I was not thinking of going—getting to geology.  
83 I worked a little in chemical kinetics, but I was interested in radioactivity and radioactive decay.  
84 When I got to Hamburg, Harteck suggested an experiment which was pretty much the first in the  
85 field of hot-atom chemistry—you know, what happens when a chemical compound undergoes a  
86 nuclear transformation.

**[END OF PART ONE, BEGIN PART TWO]**

87 **SUESS:** I had been working a little bit with heavy water and also with some radioactivity. I had  
88 measured potassium activities and in a meteorite was the same as in the terrestrial potassium.  
89 So, that was good to know. So, I had played a little bit with photons, and then, there was a little  
90 conference on the possibility of making a reactor, a nuclear reactor. But what I want to talk  
91 about now is these two papers that I did with [Johannes Hans Daniel] Jensen. It was published  
92 in 1944 and another paper that Jensen published in 1946.

93 So, this was really what I got interested during the war because you couldn't really do any  
94 experimental research. It was—. In the later part of the war, it was impossible to do research.  
95 Now, what was really a very interesting thing I appreciated is it was the best I could do during  
96 war time. It wasn't really completely lost period of time, but one thing was Harteck wants—.  
97 Well, I was assigned, I should say, the job of consultant to Norsk Hydro, to the Norwegian plant.  
98 And when I got there the first time and there were this Norwegian scientists, workers, and  
99 administrators of this plant, and I got introduced, I said, "Well, I should maybe say—well, I  
100 shouldn't say this, but to tell you the truth, I'm actually not German. I'm from Vienna. I'm an  
101 Austrian, and so, I feel I can be neutral in this kind of war." And they all said, "We are  
102 Norwegians. We are not neutral."

103 And so, everybody laughed, including me, and I had close friends there and I had got to know  
104 quite a few people, but there was a very, very sad experience with the number of lives that were  
105 sacrificed, just because the American—the politicians decided that this was more important  
106 work. That's the way I feel. But when Jensen and I went to Norway—. Jensen is a Scandinavian  
107 name and he had visited Norway many times before and knew people up there. And Jensen—

108 **FLECKENSTEIN:** So, he was working on the same project pretty much?

109 **SUESS:** Yes. Yeah. He was a theoretical physicist and he did the calculations necessary,  
110 which I didn't know. So, Jensen—Harteck and Jensen and me were in Hamburg. Grote was also  
111 playing, but not with heavy water. And Jensen came along with me once to Norway and we  
112 visited Victor Moritz Goldschmidt, who was the mineralogist there. Because my father knew his  
113 name very well and I had a reprint from his papers. And I came in—of course, Goldschmidt was  
114 very cordial and asked to see me, knew my father's name—maybe even personally, I don't  
115 know. And Jensen spoke some Norwegian but that wasn't necessary, of course. And  
116 Goldschmidt was sort of optimistic. He said, "One way or the other, things will clear up. And

117 even if the Nazis should win, they wouldn't stay there forever." But the last time I saw him, then,  
118 was a little later, because I got interested in looking at his papers. And when you know a person  
119 personally, you're more inclined to study his scientific work than if you would not know him. So, I  
120 got involved in abundances of the elements and I was very happy to have Goldschmidt's paper.  
121 It was written in Germany just before the war started, published in Norway—Norwegian  
122 Academy proceedings.

123 And, well, this is a classical paper. And then, I got interested in these problems and Harteck  
124 also mentioned that he had been doing something in that, and this was the way I got to look at  
125 abundances. And when you play with them long enough, you noticed that there were some  
126 peculiar numbers in the structure. And I spent some time thinking about what they really meant.  
127 Now, I still—I forgot.

[*Break in audio*]

128 **SUESS:** Actually, you know, when you notice something, just by looking at a set of  
129 numbers—like Goldschmidt abundances numerically calculated for the individual nuclear  
130 species for the isotopes, and you know, all of a sudden, you realize it looks as if there was a  
131 system. There were smooth lines. I didn't know why, but it's definitely exciting. And, all of a  
132 sudden, that was just about the end of the war that I realized that the data that you had on the  
133 natural occurrence of the individual isotopes wasn't a random number. It made sense. It  
134 matched—it fit together in some way.

135 **FLECKENSTEIN:** Were you working with data in addition to that that Goldschmidt had come up  
136 with?

137 **SUESS:** Well, now, you have to have two types—two kinds of data—the elemental  
138 abundance—how much is there of the element—[*crosstalk*]

139 **FLECKENSTEIN:** Which is what he had, right?

140 **SUESS:** And then, simply by multiplying the fraction of each isotope, you get the abundance  
141 of each nucleus species. And I, of course, realized that if there's something that is connected  
142 with nuclear processes that formed these elements before our solar system existed, then, it  
143 must be the individual nuclear abundances.

144 **FLECKENSTEIN:** Right.

145 **SUESS:** And not the elements, because they consist of a variety of isotopic species. So, I  
146 calculated the individual nuclear species—the abundance of that. And people like Goldschmidt  
147 had done that before, but the way to see something—this is the magic—I think that's a trivial  
148 trick to realize that these are not random numbers but that they make up a system. And  
149 intuitively you feel, anyway, that there must be something that these numbers tell you. But it  
150 becomes quite clear, when you treat the even-massed numbered species and the odd-massed  
151 numbered species separately—if you look at them—each one follows a different set of rules,  
152 and therefore, you just have to separate them and then, everything falls into place.

153 And this is, I think, the first time I did that, and I was so impressed, I couldn't sleep for many  
154 nights. It was very exciting. Showed it to Jensen and he liked that very much. He didn't know  
155 what it meant, but then, you came up with these magic numbers. It was very obvious that they  
156 were there.

157 But maybe [Otto] Haxel had told me before that there were these magic numbers and, way back  
158 in 1936, Elsassé [?] would be in America before—he was an immigrant; he left Germany—had  
159 also noticed these magic numbers. And Maria [Goeppert] Mayer didn't know that Elsassé had  
160 noticed these magic numbers. She said she didn't know. And so, we had the set of numbers  
161 and when I played with them—with these numbers—you see, that's another thing I think Haxel  
162 drew my attention to it, and maybe I can—I forgot now. See, this is...

163 **SUESS:** You have 2, 6, 8, 14, 20, 28, 40, 50, 70, 80. This is a series of numbers, but the  
164 magic numbers you see are—come from—the one series is 6, 14, 28, 50 to 82, 126, and the  
165 other series is 8, 20, 40, 70, 112. This is a simple arithmetical. So, I wrote up these numbers like  
166 here and—is this the first? I think that's the last note. Or this is the first.

167 **FLECKENSTEIN:** That's the first one. This is the second.

168 **SUESS:** That's the first one.

169 **FLECKENSTEIN:** Yeah.

170 **SUESS:** And then, see, this is the number—8, 20—so, what could that mean? And some  
171 people tried to get these numbers by changing the force field of the nucleus. Then, what you're  
172 trying to do is, get something similar to the periodic table of the elements. And you have the  
173 Coulomb field and you can quanta-size [?] this and physics gives you the periodic table of the

174 elements in some crude way. And so, what kind of force field can you use? You change the  
175 force field and—there was a physicist here. [Lothar Wolfgang] Nordheim—

176 **FLECKENSTEIN:** Nordheim.

177 **SUESS:** He's here—

178 **FLECKENSTEIN:** Yes.

179 **SUESS:** You've heard of him.

180 **FLECKENSTEIN:** Yes.

181 **SUESS:** Well, just changed the potential.

182 **FLECKENSTEIN:** He was using what they called the Wine Bottle Potential.

183 **SUESS:** The Wine Bottle Potential. Yes.

184 **FLECKENSTEIN:** The bloop [?] in the bottom. Yes.

185 **SUESS:** And to get these numbers.

186 **FLECKENSTEIN:** That reminds me of a question I had. You refer, in one of your papers, to  
187 having seen a pre-print of his paper where he was working on that. Because it didn't appear in  
188 print until right about the same time that you guys published. Was everybody just commonly  
189 sending pre-prints back and forth by that time? How did you—

190 **SUESS:** In German? Never. No. You could never see a re-print from anyone.

191 **FLECKENSTEIN:** How did you happen to see that one?

192 **SUESS:** I cannot believe that I did. Does it say somewhere?

193 **FLECKENSTEIN:** Well, it's in manuscript form. It doesn't say "pre-print". Yeah. Right here.

194 **SUESS:** Oh, I see. Oh, well, okay. Yeah. That's possible that Nordheim sent Jensen,  
195 probably. I didn't get it.

196 **FLECKENSTEIN:** Mhh-hmm.

197 **SUESS:** Because he's a physicist and he must've been in touch with Jensen.

198 **FLECKENSTEIN:** Well, the reason I was wondering is that Maria Mayer also saw it at about the  
199 same time, and it—

200 **SUESS:** Well, it was—we assumed that the nucleons had a certain quantum mechanical  
201 state.

202 **FLECKENSTEIN:** Hm-hmm.

203 **SUESS:** And only—and he considered only the odd—last odd nucleus—in order to get some  
204 scheme. And that was the first time that somebody did such a thing. But, of course, you don't  
205 get these numbers if you simply use an oscillator potential, like we did in—and a harmonic  
206 oscillator gives you this. Now, I didn't know—at that time, I didn't know what Nordheim was  
207 doing. I didn't know anything what anybody had been doing. All I knew that there were these  
208 numbers which I had seen mainly in the abundance values and what Haxel had told me. At that  
209 time, we were agreed—Haxel and I saw him in Göttingen—we agreed that these numbers must  
210 have some meanings and let's think about what that could—

**[END OF PART TWO, BEGIN PART THREE]**

211 **SUESS:** —and Heisenberg went to Bohr and pretty bluntly, although he was sort of a  
212 diplomat. So, it were that the physicists of the whole world get to an agreement not to work on  
213 an atomic bomb. And [Niels] Bohr said—had meant to say, "Not to work on atomic bomb?  
214 Everybody is morally obligated to work on atomic bomb. At least we, in the West, have to. This  
215 is absolutely necessary."

216 And [Werner] Heisenberg was shocked and disappointed. But Bohr— he thought Bohr was just  
217 thinking. He was thinking that he didn't trust Heisenberg and they would just propose not to  
218 work on an atomic bomb because the Germans wanted them to make one, which is sort of  
219 crazy. But the longer I learn about these things and the more I see about this country, I have to  
220 add in that—because my suspicion is—I have no proof for it—when I was traveling through  
221 Sweden—

*[Break in audio]*

222 **FLECKENSTEIN:** What was the experiment in physics, then, that made—

**[END OF PART THREE, BEGIN PART FOUR]**

223 **SUESS:** —he was. Look at the Kuperman spin values—where is that? Do I have it? That. And  
224 this illustrates what's going on. These are the spin values, and this is proton, and this is neutron  
225 number, and the dotted line here denotes the state that the single particle should be in if you  
226 just assume that it's a harmonic oscillator.

227 **FLECKENSTEIN:** And if you assume that the spin is due to just the last particle, right?

228 **SUESS:** If it's the last particle—it's last single particle—though it shouldn't be the last single  
229 parting. I mean, it can be any particle. And this is as far as I got. It was matching all the way  
230 through, but you can see that there's an indication that this model is meaningful one way or the  
231 other, you know? Just by looking, it fits in some places; it doesn't fit in other places.

232 So, I had to wait until Jensen show up, because I didn't know what this could mean. This is the  
233 crucial thing—and this is what helped on Jensen's notes. Look, did you know what he said. I  
234 know very clearly. He said, "I have to plot this myself. Now, let's see. What do you get from this  
235 spin?"

236 And he drew exactly this. But he didn't want to look at it. He wanted to do it himself out of the  
237 book and so, he knew what the book's meaning. And then, I remember when he came to  
238 Manganese—which is a spin  $[S = ] 5/2$  [ground state] and is a positive parity, spin one half, he  
239 said, "Oh, that can't be. That's all nonsense." And he refused. [*laughter*]

240 Then, what happened with Ruth [Suess] is—what happened with—it was winter. This was  
241 submitted in—I think it was submitted some times in February. This is March and February, and  
242 Jensen came just around Christmas, and he had a student—a girl with him coming to us. And  
243 he had a car, strangely, because his wife was a medical doctor and she was driving with  
244 methane cylinders. There was no gasoline. So, he came with his car with the gasoline—with the  
245 gas in—filled with methane in the evening, and it was snowing. And then, he said to me that this  
246 girl was leaving with him next-door. She's not very far away. He would drive her home and then,  
247 we would stay at our house. So, we went to bed within that, and the next morning, when he got  
248 up—and Jensen couldn't have been able to drive the girl home because it was so much snow,  
249 so, he had brought her back with her. There was no other place. You know, with that—so, I  
250 said, "Oh, [*laughs*] I don't want to see you anymore!" She got so furious and she went away and  
251 I couldn't finish that.

252 **FLECKENSTEIN:** So, you didn't finish that part of that—

253 **SUESS:** Until much later. Then, I came back. Yeah. *[laughter]* So maybe it would have been  
254 different *[inaudible]*.

255 **FLECKENSTEIN:** So, when did—you say you submitted the first one in February, so, you didn't  
256 get back together again until sometime—

257 **SUESS:** No, this was—then, the second was in March. Well, we were—

258 **FLECKENSTEIN:** And that's why they weren't all submitted at one time—is because—

259 **SUESS:** Yeah. *[inaudible]* *[laughter]* That was one reason. Of course, Ruth was mad until she  
260 forgave him. *[laughter]*

261 This is in March and this was in April, two weeks later. That was in 1949. So, then, Jensen  
262 came. The next time he came and looked at it—maybe that was even before then—before we  
263 sent the first one in. I really don't know when it was snowing so badly that he couldn't drive.

264 **FLECKENSTEIN:** Could easily have been later in the year or earlier.

265 **SUESS:** Yes, yes. I'm not so sure. But it was that winter. This was the first. Yeah. We just put  
266 it... Yeah. So, the physicists—then, when Jensen first said, "It's all nonsense. Couldn't be." And  
267 then, he came back and said, "Well, maybe there is something to it and maybe we should  
268 probably stick it in the note." And he wrote that note this way because that's the language in  
269 which the physicists talk.

270 **FLECKENSTEIN:** So, did he write the first note?

271 **SUESS:** He wrote all the three notes.

272 **FLECKENSTEIN:** He did.

273 **SUESS:** I mean, we're *[inaudible]* because that's written in theoretical physics slang.  
274 *[laughter]*

275 **FLECKENSTEIN:** Had you talked to Haxel anymore?

276 **SUESS:** Well, no, but when—Jensen had already written it up and it was Jensen and Suess  
277 because he had the idea of this spin-orbit coupling and it says here—it is [*speaking in German*]  
278 that's the first paper where spin-orbit coupling was mentioned. I all of a sudden remembered—  
279 he had already finished it completely when I said, "Yeah, but, now, what do we do? I promised  
280 Haxel that we'd publish this jointly?" So, he said, "Okay, we are—Haxel had been doing so  
281 much thinking about this, we have to put his name on it, too." And the—and according to the  
282 alphabet, he comes first. So, he wrote just—thought it was easy to fix; wrote Haxel on this paper  
283 without telling him, without saying.

284 **FLECKENSTEIN:** I came across a story—Joe—in some of Joe [Joseph] Mayer's papers, he  
285 said that he was in Germany right after this time—right after Maria had come up with the idea of  
286 spin-orbit coupling as well—and was talking to Haxel about the problem of magic numbers and  
287 said, "Well, Maria came up with this solution." And Haxel didn't recognize that that was the  
288 same solution that he supposedly had come up with in this paper that was being published in  
289 his name.

290 **SUESS:** It wasn't there.

291 **FLECKENSTEIN:** He didn't recognize it as being his theory, too.

292 **SUESS:** Yeah. But it wasn't—I meant, it wasn't—he didn't know, maybe, about this, because  
293 it was too close.

294 **FLECKENSTEIN:** Apparently not, yeah.

295 **SUESS:** So, did Joe think that we were all cheating of that—heard about it before?

296 **FLECKENSTEIN:** No. He just was surprised that Haxel didn't recognize that he's being—  
297 apparently, this paper—the first of the papers, at least—had already published.

298 **SUESS:** While you're saying that, there's one more thing. Haxel claims to read the papers  
299 published in English, but when you try to talk to him in English and, with respect, as a  
300 conversation—doesn't understand a word in English. [Karen Fleckenstein laughs] He doesn't  
301 read you anything. He doesn't know much English, at least in those days. He probably didn't  
302 know any English.

303 And that may be another reason why he didn't. I don't mind if he was said that Haxel—he is just  
304 about exactly as old as I am. I learned now, he's six months older than I am. But there is a  
305 language barrier.

306 **FLECKENSTEIN:** Mhh-hmm. Well, that could be it.

307 **SUESS:** You might be matched.

308 **FLECKENSTEIN:** Yeah. Another story I was gonna ask you about—Steven Moskovsky, the  
309 other day, said that Jensen once told him that he thought of the solution—spin-orbit coupling—  
310 while he was shaving. Have you heard that story?

311 **SUESS:** No. I did not. But he didn't—I mean, it was so obvious that there was a relationship  
312 between the spin or between—and the spin value and the orbital moment—the total spin. And I  
313 could see that, too, but I don't know—I didn't know the words spin-orbit [?].

314 **FLECKENSTEIN:** Well, there was a very strong feeling that spin-orbit coupling was not a strong  
315 effect. I mean, physicists, in general, thought that was not a possible solution.

316 **SUESS:** Well—

317 **FLECKENSTEIN:** That was a prejudice that they had from the '30s.

318 **SUESS:** It's from the atom where there is a spin-orbit coupling. In certain conditions, you can  
319 see that. I don't know when it shows up and probably mostly when you're dealing with magnetic  
320 atoms and then magnetic theory, what not.

321 **FLECKENSTEIN:** But, in most cases, for electrons, it's not a strong effect.

322 **SUESS:** But that's not a strong effect. That's a very minor effect.

323 **FLECKENSTEIN:** Yeah.

324 **SUESS:** And it's splitting in the level, which is where it's small.

325 **FLECKENSTEIN:** Yeah.

326 **SUESS:** And this is a big effect, which is completely unexpected. And I asked Jensen and he  
327 said, "There must be a big spin-orbit coupling." I know that he did not get this from Joe Mayer or  
328 from anybody. He thought about it. He thought about it himself.

329 But he had all the evidence—the empirical evidence—presented to him as well as plausible, you  
330 know? I don't know enough theoretical physics to know what you would call that certain effect,  
331 but what I did know is where to look up the quantum mechanical states and harmonic oscillator.  
332 And more, I didn't want to know. It wasn't important. So, maybe you don't have to say this  
333 anywhere, but what really happened was that Maria had told me that she went to [Enrico] Fermi  
334 and showed him pretty much everything that I had showed Jensen—but contrary to Jensen had  
335 to do some shaving the next morning, thinking about it. Fermi looked at it and said, "Well,  
336 wouldn't you think that this is an indication for a strong spin-orbit coupling?" And Maria said,  
337 "And then the telephone rang, and Fermi turned out and walked away. Didn't see him." And this  
338 moment—everything fell in place. Maria knew what the answer was. And she mentioned Fermi  
339 for this question. So, if you like, you can say that I've got as far as Maria got without knowing  
340 physics and then, the last touch was given by Fermi—in this country, empire, not over there.  
341 [laughs]

342 **FLECKENSTEIN:** No. I think it's a good analogy, because the way you approached all of that  
343 data and the way she approached all of that data seems to be very similar.

344 **SUESS:** She came up with the same numbers, but she didn't know anything about elements  
345 and the abundance of nuclear species. She did not consider that. Or maybe she did. What she  
346 really knew were the properties of the isotopes with the spectroscopy decay, and she's—I think  
347 she based her arguments on decay and [inaudible]. You can do that, easily, have the answer.  
348 And I [inaudible] do that [inaudible].

349 **FLECKENSTEIN:** Actually, she started with abundances.

350 **SUESS:** She did?

351 **FLECKENSTEIN:** Yeah. She did. Because she was working with [Edward] Teller on a—. They  
352 were working on a theory, the origin of the elements.

353 **SUESS:** It was that early?

354 **FLECKENSTEIN:** That was right before this. And she started looking through the abundances  
355 and working out that theory and started seeing a pattern to that. And that's what got her—and  
356 then, she went on, you know, and started looking more seriously at decay energy.

357 **SUESS:** Yeah. That was the poly-neutron efficient theory?

358 **FLECKENSTEIN:** Yeah.

359 **SUESS:** Yes?

360 **FLECKENSTEIN:** Yes.

361 **SUESS:** That was that early? I forgot now.

362 **FLECKENSTEIN:** It wasn't published until a bit later, but the work they did—well, it was  
363 published in '49, I believe. '49 or '50. But the work that they did started in about 1946, so, she  
364 actually was working on that— [*crosstalk*]

365 **SUESS:** Of course, [*crosstalk*]

366 **FLECKENSTEIN:**—before she did this work.

367 **SUESS:** Maybe Teller, all of a sudden, terms of a bomb—the poly-neutron [*inaudible*]. Yeah.  
368 Probably. Yes. Now, this is as far as I got then and then, we played a little bit in front. But—

369 **FLECKENSTEIN:** What—in several of the papers, Jensen mentions Bohr as being—he had  
370 discussed the theory with him. What was your sense of Bohr's contribution to all this?

371 **SUESS:** Well, Jensen just wanted to be nice to Bohr. He felt very, very—he admired Bohr and  
372 he had known him from before the war. And Niels Bohr was a bit... a bit—well, conceited. Of  
373 course, he was. When I came to—well, later in the war, we could travel via Copenhagen  
374 through Sweden to Norway and this was a very fascinating thing to do, but in Copenhagen I  
375 always stopped and looked around so nobody could see me and I went to Bohr's Institute  
376 [Institute of Theoretical Physics, now known as Niels Bohr Institute] and I visited [George] de  
377 Hevesy there.

378 And once I went there, and de Hevesy showed me—he showed me everything he was doing,  
379 and then, he asked me—I must have forgotten that completely—he asked me if I could get him

380 some heavy water. And I said, "Officially I have no influence on how heavy water's given, but I  
381 could do that somehow unofficially." And, indeed, I managed to steal some—200 milliliters of  
382 heavy water from a big container where we were shipping [*inaudible*]. After everybody had left, I  
383 was completely alone in the factory, and I siphoned it over with my mouth, and then, I took it to  
384 Copenhagen. And the Danish custom looked and looked into my bags.

385 He pulled out that bottle and said, "What's in there?" And he suspected what it would be  
386 schnapps. And I said, "This is a boric acid solution." He had no idea. "You wash, disinfect." He  
387 opened it and smelled it. It didn't smell and was satisfied. Would have been interesting if I would  
388 have said, [laughs] "SHHHH, Don't say anything. The Germans are watching." The poor guy  
389 would be really embarrassed. He wouldn't have known what to do. But that was one adventure.

390 They called it *Färskt Vatten*, they told me later, in Copenhagen. "*Färskt vatten*" means, "fresh  
391 water". In German, it's Frisches Wasser. [*laughter*] The code name was Frisches Wasser. What  
392 is it English? The salt water in the ocean and the fresh water.

393 **FLECKENSTEIN:** Fresh water.

394 **SUESS:** Fresh water.

395 **FLECKENSTEIN:** Yeah.

396 **SUESS:** In Danish, it's fresh water, but in German, they say, frisches.

397 **FLECKENSTEIN:** So, did Jensen discuss this at all with Bohr, then, do you think?

398 **SUESS:** Later on—well, this was a tricky thing, because Heisenberg messed it up everything.  
399 I went to—I was invited for dinner to de Hevesy's and there was a young lady, 15-years-old. Do  
400 you know who that was? She's now Jenny [de Hevesy] Arrhenius, who lives in La Jolla. [*laughs*]  
401 I didn't know that. She's a daughter of Hevesy. And she married Gustaf Arrhenius. You know  
402 who that is?

403 **FLECKENSTEIN:** Yeah.

404 **SUESS:** And the father—Arrhenius is also in that. And I ask Professor Hevesy, the father, "I  
405 would love to be introduced to Bohr just to say, 'Hello.'" And then, the next day, I was in the  
406 institute and de Hevesy said, he's a diplomat. And he said, "Professor Bohr, you know—he is a

407 bit peculiar. Wouldn't you like to be introduced to Professor [Johannes Nicolaus] Brønsted  
408 instead?"

409 Brønsted had the Nobel Prize, too. You know, Brønsted—the chemical kinetics and what's the  
410 base—acid-based comparisons. He got that for Ph.D. work. And, I had a few nice words with  
411 Brønsted, but I wasn't working in this field and I knew what it was and what he was doing, but I  
412 think like Bohr. [*laughs*] So, that was also nice. Did you take it down?

413 **FLECKENSTEIN:** No. It's running.

414 **SUESS:** What's that? Well, any more questions—

[*Break in audio*]

415 **SUESS:** While he was in Copenhagen, he did see Bohr while I was talking to de Hevesy and  
416 maybe approached—oh, there is a brief [*inaudible*] story about—you know, Bohr's institute, but  
417 that wasn't really—Jensen had nothing to do with it and I didn't either, I was watching the story.  
418 But I know Jensen—see, there was this famous discussion with Jensen and—oh, I don't—I  
419 didn't give you that book review that I wrote on this book, *The Buyer's House*. Have you ever  
420 seen that?

421 **FLECKENSTEIN:** I've—

[*Break in audio*]

422 **SUESS:** —didn't believe what Heisenberg told him. He couldn't communicate. But Heisenberg  
423 said—first of all, in Germany, nobody knew whether a bomb could really work—whether or not.  
424 And Heisenberg went to Bohr and, pretty bluntly—although he was sort of a diplomat—told Bohr  
425 that couldn't the physicists of the whole world get to an agreement not to work on an atomic  
426 bomb? And Bohr said, "You meant to say not to work on an atomic bomb? Everybody is morally  
427 obligated to work on an atomic bomb—at least we, in the West, have to. This is absolutely  
428 necessary."

429 And Heisenberg was shocked and disappointed. But Bohr—he thought Bohr was just thinking.  
430 He was thinking that he didn't trust Heisenberg and they would just propose not to work on an  
431 atomic bomb because the Germans wanted to make one, which is sort of crazy. But the longer I  
432 learn about these things and the more I see about this country, I have to add in that—because

433 my suspicion is—I have no proof for it—when I was traveling through Sweden, when I contacted  
434 everybody possible, I told everybody everything that I knew without having an inhibition or any  
435 qualms, and even I wasn't afraid of somebody denouncing me to the masses. But I was  
436 amazed/surprised that no attempt was made at all—at least later on in the war.

437 After they bombed the hydro plant in killed some 50 Norwegians, I got—I was supposed to get  
438 the message that I should report to the British Embassy in Württemberg in Sweden, because  
439 my train passed through there. But that message never reached me because it was almost the  
440 end of the war and I wasn't sent to Norway anymore. So, but nobody cared. I don't think that  
441 they really wanted to know. I don't think that the—

442 **FLECKENSTEIN:** It's possible.

443 **SUESS:** —CIA [Central Intelligence Agency]—it was CIC [CIG - Central Intelligence Group]  
444 in those days, or whatever it was called—did not want to know what was going on in Germany,  
445 because they thought the Germans—they would find out that there was nothing going on in  
446 Germany. No chance, no major efforts, which they ought to have known anyway. Then this  
447 would just discourage the American scientists over here. They wouldn't work very hard. And if  
448 they would have known—if there would have been something going on, well, that would just be  
449 just as good, because we're telling the German—the American scientists anyway that Germans  
450 are feverishly working on a bomb. So, they did not try—they did not want to know. And [Nathan]  
451 Sugarman, in Chicago, I was there when they had his 40-year anniversary of the chain reaction.  
452 Do you know that was last—

453 **FLECKENSTEIN:** Hm-hmm. Hm-hmm.

454 **SUESS:** Sugarman said, "If we had known that the Germans were so far behind, we would  
455 never have made the bomb." And I think that's true. And so, it's all the fault of the politicians.

456 **FLECKENSTEIN:** Yeah. Yeah. [*laughter*]

457 **SUESS:** But it's not in the books and who can say that?

458 **FLECKENSTEIN:** Well, you should write it up.

459 **SUESS:** No matter how he appeared, no spy trapped and seduced me while I was traveling  
460 back.

461 **FLECKENSTEIN:** That's what you wanted. [*laughs*]

462 **SUESS:** I was waiting for that. [*laughter*]

463 **FLECKENSTEIN:** I see. Okay. So, you don't think that Bohr was particular—to get back to Bohr  
464 now; we've eliminated Mata Hari. You don't think that he was particularly concerned, one way or  
465 another, with the shell model of the nucleus? Was much attention paid to it at his institute?

466 **SUESS:** I think he was. He was interested. I'm sure he was interested in the shell model. But I  
467 had to turn this around. Well—and I'm sure—but, in those days, they didn't publish anything. I  
468 don't think Niels Bohr published anything. And even though he may have thought about it,  
469 maybe it was interesting, I don't think Heisenberg was interested in the shell model. It wasn't a  
470 direct—no connection with the reactor. Heisenberg and [Otto Robert] Frisch tried to get a chain  
471 reaction going.

472 This was a prestige matter, you know? It was [Otto] Hahn discovering and the chain reaction  
473 was obviously something that could be done. And they would have liked to get the heavy water,  
474 because Haxel and [Helmut] Volz made these wrong measurements on carbon as it—

475 **FLECKENSTEIN:** Moderated?

476 **SUESS:** – moderated. It wasn't their fault, because there were no chemists and the stuff was  
477 dirty. And I don't know what was in there. It could have been boron. It could also have been  
478 hydrogen because that graphite wasn't very clean. And probably the measurements were good  
479 measurements, I don't know. But there was no mass spectrometer and there was very little  
480 equipment and very little [*inaudible*].

481 **FLECKENSTEIN:** Hm-hmm.

482 **SUESS:** Wet chemistry is what these Germans was still strong at. The wet chemistry—which  
483 is at home in Vienna—doesn't cost much money. And wet chemistry was very useful for these  
484 things. Then [Fritz] Strassmann and Hahn did all the fission products, measured the fission  
485 products, and—but no mass spectrometers that were working with power [*inaudible*]. And it was  
486 hopeless to get anything done in a hurry—not done in a hurry.

487 **FLECKENSTEIN:** What role did Victor Weisskopf play in all of this, in your—did you talk with  
488 him or did Jensen talk with him?

489 **SUESS:** Well, Victor Weisskopf had left already. And he was not in Germany.

490 **FLECKENSTEIN:** Not during the war, but I mean, afterwards, when you and Jensen were—

491 **SUESS:** Yeah. Yes. Victor was another stories and jokes. I met him when I was visiting [Fritz]  
492 Houtermans in Göttingen. And then, all of a sudden, Victor Weisskopf walked in and they were  
493 happy and hugging each other. Houtermans And Weisskopf—and then they asked—  
494 Houtermans ask him—of course it was the first time Houtermans I should mention was a real  
495 close friend, because they both were very left before Nazi times. And now they were not. They  
496 were both cured completely. And so, he told us all kinds of stories. And he said—well, one story  
497 I remember—when he was told to expect the New York airport, three British gentlemen. It was a  
498 time when nothing went forward with the Manhattan project or it hadn't existed yet. But here,  
499 they were fighting about rules and regulations, I think, with security matters and rules and no  
500 work was possible. And then, it was announced the three British gentlemen would arrive in New  
501 York, and Weisskopf would—

502 **FLECKENSTEIN:** Meet them?

503 **SUESS:** —would meet them at the airport— I'm working now. Go away. It was like, "Oh.  
504 Okay." Out.

505 **FLECKENSTEIN:** Was that the "Nicholas Baker" story?

506 **SUESS:** What is that?

507 **FLECKENSTEIN:** The one when it was Bohr and his son?

508 **SUESS:** No.

509 **FLECKENSTEIN:** That's a different story?

510 **SUESS:** I don't know this story. No, Bohr was not involved.

511 **FLECKENSTEIN:** Oh, well.

512 **SUESS:** Everybody was wondering if Viki [Victor] Weisskopf was top secret, was waiting for  
513 his three British gentlemen. And then, the plane arrived many hours later and then, who was  
514 there? [Franz Eugen?] Simon, [Rudolf] Peierls, and Frisch. Simon was from Berlin, Niels was—

515 no Simon from Breslau [also known as Wrocław Poland], Peierls from Berlin, and Otto Frisch  
516 was from Vienna originally. These were the three—

517 **FLECKENSTEIN:** Three British gentlemen.

518 **SUESS:** And then, they met, and then they sat together to discuss what they found and then  
519 one of them said, "Let's speak German. Yiddish is not "die liebste Sprache. Nur versteht es jetzt  
520 vracht" [?] [*laughter*] So, but I think like, Weisskopf just was proud of the fact that—the  
521 development of the atomic bomb was a Jewish achievement. He doesn't deny that. And, of  
522 course, I can't blame them because of the really—that was the answer. But I have another  
523 theory about all this. But it has nothing to do with it.

524 **FLECKENSTEIN:** Well, you can tell me after we finish this then. I'd like to hear it. Let's go on  
525 and talk about those last two papers for a minute. It sounds like we can clear them up pretty  
526 quickly. Jensen wrote both of those you say?

527 **SUESS:** Jensen what?

528 **FLECKENSTEIN:** Jensen wrote both of those, the last two papers—the long one in 1950 and in  
529 1952?

530 **SUESS:** Yeah. We discussed it, but he did the writing because he was the physicist who  
531 could put it in the right words.

532 **FLECKENSTEIN:** Yeah. Well, my question was—I think it's in the 1950 paper—that you first  
533 used that diagram where you have the harmonic oscillator potential and a square well potential  
534 and you sort of take an interpolation in between for the energy levels.

535 **SUESS:** Yes.

536 **FLECKENSTEIN:** And I was wondering about—I mean, that's sort of a classic element of the  
537 single particle shell model now is that particular diagram, and I was wondering about the origin  
538 of that. Did you discuss that?

539 **SUESS:** Well, I drew the left side, with the oscillator and gave the numbers and everything  
540 and also, the splitting of the level, but I don't know what the square well potential—I don't think I  
541 could find the solution of this written equation for the square well model anywhere in the books.

542 But, of course, it's there somewhere, so, I didn't bother because Jensen wanted to have it there.  
543 Maria did not do it this way, did she?

544 **FLECKENSTEIN:** No. She used the square well potential. She didn't use the harmonic  
545 oscillator. That's why it—

546 **SUESS:** Oh, she didn't at all use—

547 **FLECKENSTEIN:** Not in the beginning. And then, when you get to the later—like the textbook—

548 **SUESS:** But I think the harmonic oscillator fits almost nicer. I don't know.

549 **FLECKENSTEIN:** Well, it depends. I can't remember. One fits better for light nuclei and one fits  
550 better for heavy nuclei material. I can't remember which is which. But I—

551 **SUESS:** And they took it then in between.

552 **FLECKENSTEIN:** Yeah. But I just wondered if you remembered any discussion of that. You  
553 worked entirely with the harmonic oscillator.

554 **SUESS:** Yeah. Well, this is so simple and it's also going to show the students that you have  
555 such a simple answer. And when I talk about this in my class on cosmo chemistry and I tell  
556 them that this is not what I want to say, is not something that is important to know in  
557 connections with nuclear physics—it's nice to know, but I'm not teaching nuclear physics here—  
558 but it's a beautiful example as to how science works because you don't have to be an expert in  
559 the field and still, you can contribute something. It's usually nature is presenting you with some  
560 very simple answer. And one of them is this scheme of numbers that gives you the magic  
561 numbers. And the interpretation is the product of very sophisticated mathematics, but you don't  
562 have to know that, because it's sort of trivial to get to these answers.

563 **FLECKENSTEIN:** Hm-hmm.

564 **SUESS:** This is one thing that I'm telling students. They shouldn't be afraid of involved  
565 mathematics—at least I wasn't. And you just have to look at the facts of the experimental values  
566 and the numbers and the dates. If they're correct, then you must be able to interpret them. You  
567 don't need to have the involved theories to do that. You can get the theories out of the  
568 experimental data, but you shouldn't try to get experimental values out of the theory.

569 **FLECKENSTEIN:** Right. You can only go in one direction.

570 **SUESS:** Especially with a theory that you don't know if it's correct.

571 **FLECKENSTEIN:** Right. One of the problems, as I understood it, about the acceptance of the  
572 shell model was that, of course, the compound nucleus was very successful in explain things  
573 like fission and it was the model that most people worked with throughout the war—  
574 particularly—

575 **SUESS:** For calculating fission.

576 **FLECKENSTEIN:** Yeah. And explaining all that sort of thing. So, that's the model that most  
577 nuclear physicists were accepting at this time. Do you have any recollection of how people  
578 reconciled the two? I mean, you've got two sort of opposing views and it seems to me the shell  
579 model was accepted pretty quickly once it was suggested.

580 **SUESS:** Well, it took about six or eight years, because the strange thing is—were the  
581 physicists. It's always the same story. The physicists have to have one experiment that gives  
582 you an answer "Yes" or "No" and that—they accept that thing. The other fields of science—  
583 especially geologists or biologists, too—they take a multitude of inexplicable phenomena  
584 pointing in one direction, but none of them really proving what the source is. But if you have  
585 always the same indication—for example, for a magic number—people used to say, "There is  
586 no such thing as a shell structure or as individual numbers. You cannot use Bohr's theory of the  
587 atom from the nucleus and what not."

588 But if you always get the same number—which could be an accident, of course—they say,  
589 "Well, that's an accident—that there's so many stabilizer domes with 50 neutrons contained in  
590 50 neutrons. That just happens everywhere. In other parts of the pyramid table, you have that  
591 many and it has nothing to do with any magic number. So, that must be just accidental, or it's  
592 hidden away." But the scientists who work intuitively—like a geologist who has to have a  
593 multitude of indications pointing in one direction, you cannot prove anything. They are  
594 convinced—for example, continental drift.

595 **FLECKENSTEIN:** Mmh-hmm.

596 **SUESS:** There must be that way. But the geophysicists refuse to believe it as long as they  
597 don't have one observation that shows conclusively that this must have been the fact. And

598 actually, now, they have two or three such observations. I said it was the ocean floor spreading  
599 that convinced them that the continents moved apart. Now, Keith Runcorn—he was always  
600 around; I don't know if you met him.

601 **FLECKENSTEIN:** No.

602 **SUESS:** Well, he's an Englishman who teaches at the University of Newcastle but he spends  
603 half his time flying around in the United States. So, that is why everybody knows him. Keith  
604 Runcorn told me that it was the magnetic field change that—and the magnetic measurements—  
605 because that's his field—that convinced the geophysicists of continental drift. Completely  
606 independent observation. But they won't believe what the geologists tell them—that if you look  
607 at the minerals, the rocks and the petrology of the individual strata—that this belonged together.  
608 That they don't believe, because they don't see, and characteristic rock, what belongs to what.  
609 That's complicated. You can't prove it.

610 **FLECKENSTEIN:** What was the experiment in physics, then, that made physicists accept the  
611 shell model?

612 **SUESS:** Oh, yes. And that's what I was driving at. There was a scattering experiment. The  
613 proton beam deflected by—I don't know. Was it proton/proton scattering?

614 **FLECKENSTEIN:** I think so. Are you talking about the Friar and Lusenfeld [?], or somebody like  
615 that?

616 **SUESS:** Yeah. Something like that.

617 **FLECKENSTEIN:** Yeah.

618 **SUESS:** There was this review you should see. If a single proton that's aligned in some way  
619 by some molecular atomic beam set up—scattered in two ways or in one way. And that  
620 experiment—the scattering of protons, I think—I didn't follow this up, but that was just at the  
621 time when I moved to Chicago and was at the University of Chicago. And I didn't--

622 **FLECKENSTEIN:** Yeah. I think that was done in 1952.

623 **SUESS:** Yeah. And I came in 1950 to Chicago. And I just heard roughly and—

624 **FLECKENSTEIN:** Actually, that experiment was done by one of the professors at the University  
625 of Minnesota and he says that they—it was not ever intended to demonstrate spin-orbit  
626 coupling. They just—they suddenly realized that that's what it showed. How else does a  
627 compound—[cross talk]

628 **SUESS:** Yeah. That's what they convinced the theoretical physicists—of course, many other  
629 people were convinced anyway.

630 **FLECKENSTEIN:** Yeah.

631 **SUESS:** There was just the opposition.

632 **FLECKENSTEIN:** Do you think people had trouble reconciling the single particle shell model  
633 with the compound nucleus model then?

634 **SUESS:** Well, it must be possible. I don't know. That's a job—

**[END OF PART FOUR, BEGIN PART FIVE]**

635 **SUESS:** Well, when I came here and then, I found that [Harold] Urey was mostly interested in  
636 the abundances of the elements—you know, Harrison Brown arranged for me to come to  
637 Chicago, and I think it was the first and only one, in those days, who came on a private or  
638 university invitation. All the other scientists from occupied Germany were offered jobs from  
639 army/navy organizations and they did military. I didn't come, like the other stories are.

640 **FLECKENSTEIN:** You came in 1950?

641 **SUESS:** '50, yes. And it took me a year before I got the visa. That was a very funny story,  
642 cause Ruth was over here. She happened to be born in Saint Louis, Missouri.

643 **FLECKENSTEIN:** Oh. [laughter]

644 **SUESS:** And just, after the war, I said, "Let's get them. You can get an American passport."  
645 So, she went to Swiss Consulate and registered as being born in America and American  
646 citizenship, but she didn't have a birth certificate. She had every other document [inaudible]. So,  
647 there was an uncle of hers still living in Saint Louis and she had his address.

648 After a year, they said, "Bring \$10.00 and you get the American passport." So, it was—she had  
649 to scrounge up \$10.00, which is not much, and then, she got the passport and then, she had to  
650 come to the United States. And she didn't know where, so she wrote to all her relatives over  
651 here and a niece of hers was over here. That actually is a first great cousin that happened to be  
652 here, and then, she came alone because I didn't have the passport. And then, I was—

653 **FLECKENSTEIN:** Did you have children then?

654 **SUESS:** Yeah. We had one daughter.

655 **FLECKENSTEIN:** Did she come, too?

656 **SUESS:** No. She was in—she stayed with my mother in Vienna. She stayed with my mother  
657 in Vienna. She'd been staying with my mother before, during the last weeks of the war. But  
658 then, she was over here and went to Washington and then, I had to first get a job here because  
659 I can't come and—then, Harrison Brown, she got in touch with several people, and Viki  
660 Weisskopf gave me an affidavit of support, which I didn't really need.

661 But Chicago then invited me, and I applied for a visa and it didn't come. Then, they wanted to  
662 know what my activities were in Nazi times in Germany and they found out I had been working  
663 on heavy water. And then, this consulate send it back to Washington and it took half a year and  
664 nothing happened. I couldn't get transportation. It was terrible thing.

665 And finally, Ruth came back. She had made \$50.00 a week or something like that—much more  
666 than I—while she was over here, and then, she came back to Germany. We went to the  
667 American Consulate and then, a few weeks later, they contacted me and they told me the story  
668 that there was this line—that, "You know we have to be very careful when you have that  
669 experience and you had a very strong recommendation from the British government, but so  
670 have [*inaudible*] folks" they said. [*laughter*]

671 **FLECKENSTEIN:** Sort of like, no recommendation. [*laughs*]

672 **SUESS:** Well, they finally let me come in America. But when I came, Urey was already  
673 interested. Now, Harrison Brown—you know him?

674 **FLECKENSTEIN:** Mm-hmm.

675 **SUESS:** He lives in Albuquerque now.

676 **FLECKENSTEIN:** I don't know him personally, but I know of his work.

677 **SUESS:** Yeah. So, Harrison Brown got me the invitation to get to Chicago and that was fine  
678 and wonderful, and I was very impressed. But the Chicago—that's everywhere like Chicago  
679 University, Chicago the city, it's a wonderful place. Unfortunately, it's not all around the country  
680 the same way.

681 **FLECKENSTEIN:** Yeah.

682 **SUESS:** But Chicago was just an excellent place with the most brilliant people. And Urey  
683 came and he looked at the abundances and he was impressed and, you know, the way I could  
684 show it was that the abundances of adjacent elements fit together like in a jigsaw puzzle. You  
685 know, you can match them and then, everything has some pattern to it. And Urey loved that and  
686 he, for years, so, he placed with his jigsaw puzzle, shifting around. *[laughter]*

687 I got him completely hooked on the abundances, and then, he said—we published together.  
688 That was wonderful. Then, people pay some attention to you. That was important. Then, we  
689 have the data subtext and *[inaudible]* and then, Urey said, "You have to be the senior author."

690 And I said, "Well"—"No, no. You have to be the senior author." I said, "Well, in Europe, we  
691 always put the names in alphabetic order." "No, no, no. You have—" "Okay. Okay. I'll go ahead  
692 and do it." *[laughter]* Because what could I have said? *[laughter]* I think he was based in  
693 Copenhagen for a time so he was paying attention to my German papers. Except this—because  
694 of the Nobel Prize—it's located—let's see what the sequence of the next were. We were so  
695 close.

696 **FLECKENSTEIN:** Speaking of the Nobel Prize, what do you think was the reason for Jensen  
697 getting the prize and you and Haxel being excluded? Was that a political—

698 **SUESS:** No, no, no. I wrote an excellent essay. Now, the Nobel Prize is—I'm so glad to have  
699 it and the Nobel Prize is not divided into *[inaudible]* pieces. That's not been done. He was a bit  
700 offended, I think, and he *[inaudible]* that, you know? After, he thought that *[inaudible]*. They got  
701 along very well near the end *[inaudible]*. Together—I think they have the same birthday.  
702 *[inaudible]* It was, so to speak. That's why I *[inaudible]*.

703 **FLECKENSTEIN:** Mm-hmm.

704 **SUESS:** [*inaudible*] [*laughter*] But, well, later on, we didn't get in touch with so much anymore.  
705 He came here to visit me, but, of course, we wanted to see Maria, but fortunately, Maria and  
706 Joe [Joseph Edward Mayer] were more and more disregarding their health problems and losing  
707 their healthy way of living. But Hans Jensen died just a year or two after Mayer died, but that  
708 had another reason.

709 **FLECKENSTEIN:** How's that?

710 **SUESS:** That was in connection with what's his name? [*inaudible*] the physicist—the German  
711 whom Jensen was collaborating with, who was admiring and liking very much, till it was a big  
712 project in [*inaudible*] and Heisenberg had cooperated and he did filter the high energy  
713 experiments that cost millions of Marks. And then, somehow, he was denounced by some  
714 secretary [*inaudible*] and then, they checked up and found that he had transferred all his  
715 research funds to a Swiss bank account and then, had bought a house in Geneva Switzerland,  
716 supposedly because it was cheaper to own a house than to have his coworkers live in repair.  
717 And lots of things like that.

718 And Jensen was terribly upset that I'm checking up on such successful physicists but then, the  
719 worst thing was that they put him in jail for two years because of the—that was the difference  
720 with the American system—is that you have to have—everything you—the way you spend your  
721 research funds is administrated by the university and you really can't do quite what you want to  
722 do and it's tedious to get things—you can't buy things where you want them to. And in Germany,  
723 the head director can do what he likes with his research funds. [*laughter*]

724 He mustn't do it in such a way that he cannot prove anything. And he really spent a lot of  
725 personal private money and his son was dying [*inaudible*] and couldn't find out where the money  
726 came from, and he couldn't show what he had done with his research funds. And that's what  
727 really did to him. I think he had a job with some company, but in any case, it upset Jensen  
728 terribly and he died of a heart—it wasn't an ordinary heart attack. It was a hemorrhage in his  
729 heart.

730 Couldn't be fixed. They're not very good in Germany of these things. They were not in those  
731 days. So, that was very unexpected. But Urey spent a year of his life—or almost a year—  
732 playing this jigsaw puzzle with the abundances, the abundances rules, and we wrote this paper  
733 together, and then, later, had some success with his work. If Urey hadn't paid any attention,  
734 probably nobody would have.

735 **FLECKENSTEIN:** Well, you've had plenty of success with it since then, so...

736 **SUESS:** Within what?

737 **FLECKENSTEIN:** You've had plenty of success with it since then.

738 **SUESS:** Yeah. With the abundances.

739 **FLECKENSTEIN:** Yeah.

740 **SUESS:** Sure. Now, Urey got the Nobel Prize. Now was very nice. Willy [William Alfred]  
741 Fowler didn't get the Nobel Prize and he always mentions it, and then, I was there at the 70th  
742 birthday part—the big colloquium in Pasadena. And Willy Fowler gave the—no, somebody else  
743 gave it to him, but Willy Fowler stood up and he said he should mention that "All our work was  
744 based on the way Suess and Urey treated the data, and unfortunately, though Urey is not at  
745 this, but Suess is here, and let's give him a hand."

746 Now, that was very nice of him. That was before he had the Nobel Prize, but maybe—so, then,  
747 there were two Nobel Prizes, but, of course, Harold had a Nobel Prize before.

748 **FLECKENSTEIN:** He wants to speak?

749 **SUESS:** He wants to say something too. [*laughs*]

750 **FLECKENSTEIN:** But your work was the basis for more than one Nobel Prize.

751 **SUESS:** Well, the real Nobel Prize—maybe I should get something in for [Willard Frank]  
752 Libby's Nobel Prize, because Libby—

753 **FLECKENSTEIN:** That's right. Yeah.

754 **SUESS:** Libby has this genius method of carbon-14 dating and he got the Nobel Prize, but at  
755 that time, just when we got the Nobel Prize, I found out that his data needed a correction and  
756 the whole scale had to be calibrated. And Libby didn't want to believe that for quite a while and I  
757 was the one who convinced him. Nobody else. Because he said, "Well, I don't have to believe  
758 what in a system to face the second great university entails."

759 That was this guy Fergus at the University of Arizona. He had done all his three ring  
760 measurements and he thought there was something wrong with the three rings because it didn't

761 give the—the answer didn't show up. So, he wrote some paper that there must a mistake in the  
762 three ring sequence, but he was correct and—but then, it's not surprising that now—I mean, I  
763 thought that this was an interesting discovery that something changes worldwide over the whole  
764 earth and that's the carbon-14 in the atmosphere, and it varies with solar activity, and I  
765 maintained it had to do with the climate—the global climate. There is a parameter which affects  
766 the global climate worldwide, over the whole globe, and that's important to have. And you  
767 should do that.

768 But the moment that published, it kind of "Oh my gosh." The meteorologist are against that.  
769 They spend all their money on computer programming of weather map predictions and, of  
770 course, they put in the present synoptic values, and the computer is supposed to tell you what  
771 the weather will be the next month or years, and so on. And that was very expensive. But now, if  
772 they would have to put in the sun as an additional factor, then, it would screw everything—the  
773 whole thing, and there would almost impossible to consider. So, they don't want the sun to have  
774 an effect on the climate, otherwise, all these past millions of dollars will be wasted.

775 But, I don't have anything against the sun. I couldn't understand why they got so upset about the  
776 sun. But now, we've proven that this is the case and shown that to the space scientists and I've  
777 had them analyze that data and you should see mathematical proof that there is an effect from  
778 the sun globally all around. But if you—you shouldn't say such things.

779 **FLECKENSTEIN:** At least not if you want grants.

*[Break in audio]*

780 **SUESS:** Yes. You have my permission to do anything you like with what I had said on this  
781 tape, except I'd like to have a transcript myself and be free to use it somewhere else.

**[END OF PART FIVE, END OF INTERVIEW]**