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*The Princeton Mathematics Community in the 1930s*
*Transcript Number 4 (PMC4)*


# ROBERT CAMERON

**This is an interview of Robert Cameron in his office at the University of Minnesota on 31 July 1984. The interviewer is William Aspray.**

**Aspray:** Could we begin today by your telling me something about the circumstances under which you came to Princeton?

**Cameron:** I got my Ph.D. at Cornell University in 1932. I continued to teach there for another year. Then I received a National Research Council Fellowship, and I started at Brown that fall working with Professor Tamarkin. Strangely enough, one of the leading professors at Princeton, whose name I can't remember at the moment, wrote Professor Tamarkin a letter saying that he had heard Cameron was with him and that he thought this was a mistake because Cameron was working in almost-periodic functions and there was a man at Princeton, Salomon Bochner, who worked much more directly in that field than Professor Tamarkin did. Tamarkin was upset and angry at the interference, but at the same time he said, "Even though I feel it was none of his business, I think he is right. I think you would be better off with Bochner than with me."

**Aspray:** It sounds like the sort of thing that [Oswald] Veblen would do.

**Cameron:** Well, Veblen wasn't the one. It was one in topology.

**Aspray:** Lefschetz?

**Cameron:** That's the one. Tamarkin was rather angry at Lefschetz, and yet he felt that it was good advice for me. He thought that Bochner would be of more help to me than he himself would, so he advised me to go to Princeton, which I did the first of the year,

January 1934. I was married, and we hunted for a place to live and found a second-storey apartment quite some distance from the University. I didn't mind walking.

**Aspray:** Professor Tucker told me that he thought that it was at Princeton that you got married.

**Cameron:** No, I was married in '31 when I was at Cornell, actually in Philadelphia, but I was at Cornell at the time, teaching and doing research. I got my degree in '32, and then the two of us went to Brown in '33 and to Princeton in January of '34. Because I was married I couldn't just get a single room the way a single man might.

**Aspray:** Weren't you in the minority among the post-doctorate students in that you had your wife there with you in town?

**Cameron:** Perhaps I didn't know them all. But there were others who had their wives with them. We would visit them at their apartments and spend the evening in discussions. Those were the days of the Depression, so the topic of conversation, the topic on everybody's mind and lips was 'Are there any jobs?'. I attended Bochner's lectures but couldn't tell you the title anymore. I also attended Professor von Neumann's lectures. Professor Lefschetz was horrified when he found out that I never had any topology, and made some suggestions. Actually I attended his lectures for a while, but I needed more background and I didn't want to go back and take the undergraduate courses. So that part of my education has always been neglected.

**Aspray:** What about your own research during this time?

**Cameron:** For my Ph.D. degree I had written a thesis on almost-periodic transformations. My thesis advisor, Professor Wallie Hurwitz, worked on summation of infinite series. I was led to the subject because I worked on periodic transformations for my master's degree, and obviously there are related transformations which are in a precise sense almost-periodic. For instance, suppose you rotate something through forty-five degrees. This is a periodic transformation. Do this eight times and come back to where you were before. But suppose you rotated through 1 radian, which is an irrational multiple of 1 revolution. Then as you go around, you'll come back very close to where you started and then go away again. You'll come back close and go away again. This process will bring you as close as you please over and over, but you keep going away again. This gives you an idea what I mean by an almost-periodic transformation. Professor Harald Bohr came and gave a lecture at Cornell on almost-periodic functions, and I thought this was just what I needed for almost-periodic transformations. I asked Professor Hurwitz if I could write on almost-periodic transformations. He said, "Yes, you can if you're able to do it all by yourself. I'll let you, but it's not in my area of research."

He was very considerate as this was really something quite new. One man, whose name I don't remember, had done just a little bit on it,

but he hadn't even made a very useful definition. So in a way this was striking out in a new direction, and perhaps this is one reason why I was granted a fellowship. Anyway, they gave me good recommendations, and I did get it. I tried to go on in this area at Brown and thought I had made a little progress. Then I read some work of Bochner's that suggested some differential equations with almost-periodic coefficients. I began writing on that, and so it was natural to transfer to Princeton to work with Bochner. I continued writing in that area and wrote a number of papers on differential equations with almost-periodic coefficients.

**Aspray:** Some of these were written while you were at Princeton?

**Cameron:** Yes. I have reprints of them somewhere. They didn't come out then of course, because publication takes time.

**Aspray:** How closely did you work with Bochner?

**Cameron:** Really not very closely. I hadn't worked closely with Hurwitz, and I didn't work closely with Bochner. I did attend his lectures and read his papers, but what I did didn't really come out of conversations with anyone.

**Aspray:** Were there other people at Princeton that you talked mathematics with?

**Cameron:** Not much. I tended to be a loner. Since then I've been more sociable; my research has been in cooperation with others.

**Aspray:** I've found in doing these interviews that many people were so involved in their own work that they didn't talk much to other people. So you're not unusual in that regard. People have told me that Bochner was a good advisor for graduate students anyway, because he was always careful to help them pick suitable problems, and he was an especially good judge of what was do-able, good mathematics. Can you comment on that?

**Cameron:** I didn't have much contact with him in that way. Actually after I came here [to Minnesota]—I came in '45—as we sought other people, he gave some good advice. He suggested Guggenheimer, he suggested Gelbaum, and he suggesed Furstenburg. All very fine people. None of them are here now. For a time they were here and added much to the math department.

**Aspray:** Professor Tucker suggested that you might have had some occasion to work with, or at least interact with, Bohnenblust.

**Cameron:** No, actually I didn't. I don't think I even saw him very often. Of course I did see him, but not very often.

**Aspray:** Did you get to know von Neumann very well?

**Cameron:** No, I didn't know him to talk to him. I went to his lectures. He was a superb lecturer. Superb. But I didn't actually go and talk to him. I had this contact with him. I was there for half a year in the '33-'34 academic year.

**Aspray:** For the second half of that year.

**Cameron:** Then my fellowship was renewed, and I was there in the '34-'35 year. Toward the end of that year the job situation got to be more and more a matter of concern. At that time, toward the end of that spring, von Neumann very kindly saw me and said that if I hadn't anything for the next year that they could provide something for me.

**Aspray:** Through the Institute.

**Cameron:** I think so, yes. But as a matter of fact I had just shortly before that accepted a position at MIT. I appreciated his kindness however.

**Aspray:** Did you get to know either Weyl or Morse while you were at Princeton?

**Cameron:** A little bit. Weyl had a group of us to some sort of a dinner or entertainment. I don't remember just what it was. It was at his house. I don't remember if I got acquainted with Morse at that time or not. When I was back in '53-'54, the Morses had us over to dinner. Now it may be that I got to know them then, but my memory doesn't allow me to be sure.

**Aspray:** Did your wife work while you were in Princeton?

**Cameron:** No, she didn't. But she was a very sociable person, and she got to know people much better than I did. So it's probable if you're in the area you could get more information about who we met from her than from me.

**Aspray:** I've heard stories from four or five people about how Mrs. Eisenhart or Mrs. Veblen would call on the wives of graduate students or on the graduate students themselves.

**Cameron:** Mrs. Eisenhart and Mrs. Veblen were very kind to us and had us over to dinner several times.

The Institute was just beginning and was housed in Fine Hall. They were very courteous and, although I was technically working at Princeton, gave me and the other National Research Fellows who were there—there were many others—membership in the Institute at the same time. So I was invited to a lot of parties at the Institute. My wife sat next to Professor Einstein at one of those parties. Then when we were there in '53-'54 I remember she was going from the Institute, which had its own place at that time, up to the town of Princeton. She met Professor Einstein, who was making the same trip, so they walked along together. So she got better acquainted with him than I did.

**Aspray:** Do you remember going to teas in the common room?

**Cameron:** Yes, a number of them. I suspect that some of these were sponsored by Professor Eisenhart.

**Aspray:** After the Fine Hall was opened the Department sponsored the tea every day and in fact had funds from the Department to put the tea on.

**Cameron:** Yes, by the Department you mean Princeton University.

**Aspray:** The University's Department of Mathematics.

**Cameron:** Well, while I was there that time the Institute was within Fine Hall. Did those teas at the Department go on as long as '52-'53?

**Aspray:** I think so, I think in fact they continue today. Often the people from the Institute would attend the teas.

**Cameron:** I see. They were very nice pleasant affairs.

**Aspray:** Did you have office space in Fine Hall?

**Cameron:** Did I have an office? I'm trying to think. I think I had a niche in an office or a place to put my books or something like that.

**Aspray:** There were carrels in the library, up on the third floor.

**Cameron:** I think that's what I had.

**Aspray:** Are there any things you'd like to tell me comparing Cornell, MIT, and Princeton in the Thirties? How lively a mathematical center was each?

**Cameron:** Of course Princeton was a very lively mathematical center. I'm sure it was by itself. And then the Institute had just joined it, so it was very lively. People were coming there, both to be at the University and at the Institute. I had been very happy at Cornell, and there was interesting research going on, but not to the degree it was going on at Princeton.

**Aspray:** Several people from Princeton at that time soon went to Cornell to teach. I think of Barkley Rosser and Robert Walker.

**Cameron:** There was one man who went there from Princeton earlier, William Flexner, in topology. There was an interesting situation, with all this concern about where would we go to teach, where we were going to be, all that was going on. Professor Hurwitz came to Princeton and interviewed me and asked me if I'd like to go back to Cornell, I said I'd like to very much. That must have been in '35. But it didn't go through because the dean felt there was too much ...

**Aspray:** Inbreeding?

**Cameron:** Yes. Another man before me, Ralph P. Agnew, got his degree at Cornell, got a National Research Fellowship, and then came back to Cornell. For another one to do that was just too much. The dean wouldn't allow it. And that was the problem, or at least a worrisome situation. So I had to look elsewhere. I think the Institute was aware of that; that may have been the reason why von Neumann later offered me some sort of an assistantship there.

**Aspray:** Did you get to be close friends with any of the other post-docs that were there at the time?

**Cameron:** Yes, what was his name? Well, my wife remembers. We used to get together frequently and it seems to me he was given a position at Princeton. I can't remember his name. There was a group of Christian boys that I had fellowship with. I went to some of their meetings. And there's a place there at Princeton that they use for Christian meetings. [Murray-Dodge Hall.]

**Aspray:** I guess I don't know.

**Cameron:** Anyhow, they were having a meeting there, for which they were putting up a sign. It was about the Second Coming of Christ. It seems that Professor Einstein took daily walks, and he walked by and saw this sign. Some of the fellows were there; I guess they had just put the sign up. He asked them what was this about, what does this mean "The Second Coming of Christ"? They told him that Christ came the first time to fulfill the prophecies of suffering and to fulfill the types; animals that had been slain as sacrifices were types of His great sacrifice when He died on the cross to pay the penalty of the sins of the world. He said He died for our sins, and He promised that He would come again and that when He does come again He will come in power to take over the reigns of government and run the world as it should be run. I wasn't there to hear it, but they quoted Einstein as saying, "Well, if he's coming, he'd better come soon." Which is all the more true today.

When they were starting the Institute they did a great deal of entertaining, so we were invited to many very fancy dinners at the Princeton Inn and to smaller gatherings with refreshments at Fine Hall. It was at one of these dinners that, as I say, my wife sat next to Albert Einstein. And that occasion, or perhaps another time, but at one time when he was there speaking at one of these dinners, he was introduced and said, "No, I'm not going to speak in English." And he spoke in German. I guess later he became more comfortable with English.

It was a marvelous time with all those mathematicians there. I am very grateful to Princeton for its kindness and hospitality to my wife and me.