History of RSB Interview: Ta-Feng Lin

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Interviewers:
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PC: Can you tell us a bit more about your family and your studies before starting university?

TFL: Following my earlier education in Taipei city, I studied mathematics at the National Taiwan University from 1959 to 1963; I received my PhD from Purdue University (1965 to 1968) later went to Rockefeller University for postdoctoral work. While I was at The Rockefeller University, I married Chen-yeh Huang, the younger sister of my college classmate. We raised two children who now live in the neighborhood nearby and we have a family get-together every week.

PC: How did you get interested in mathematics/physics, and then to pursue a PhD in probability at Purdue[1], with Professor Baxter[2]?

TFL: In the nineteen fifties, I became fascinated with the Russian satellite Sputnik[3], which prompted my decision into the field of natural sciences. I received my B.S. degree in mathematics, was accepted into the graduate program of Purdue University with financial aid and eventually chose to study probability with Professor Baxter after having taken his probability class.

PC: What led you to work at Rockefeller with Professor Kac[4]?

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[1] Ta-Feng Lin, *A Discussion on Brownian Motion of 1-Dimensional, Continuous Mechanical System in a Viscous Medium*, PhD Thesis, Purdue University (1968). https://purdue.primo.exlibrisgroup.com/permalink/01PURDUE_PUWL/uc5e95/alma99170057252301081
[2] Glen E. Baxter: https://en.wikipedia.org/wiki/Glen_E._Baxter
[3] Sputnik 1: https://en.wikipedia.org/wiki/Sputnik_1
[4] Mark Kac: https://en.wikipedia.org/wiki/Mark_Kac

TFL: I believe that Professor Baxter had recommended me to Professor Kac, which was why I received a letter from Professor Kac who offered a research associate position to me before obtaining my Ph.D. degree.

PC: How was the mathematics department at Rockefeller functioning (e.g., meetings, community, advising, etc.)?

TFL: I can only remember some of the people who worked there: McKean[5], Uhlenbeck[6], Riordan[7], and Schreiber[8]. At the time there were no undergraduate students in Rockefeller University.

PC: One of the problems you worked at Rockefeller was that of the disordered chain. How did you get started on this problem?

TFL: Actually, I was never exposed to statistical mechanics before I met Professor Kac; he had taken a chance with me, a mathematician naïve to this field, and suggested that I start by reading books and [a] preprint related to this field first (for about 7-8 months) before he gave me a problem.

PC: From what I understand, this problem was motivated by a 1968 preprint by Professor Kac[9]. Do you know why this preprint did not get published at that time?

TFL: No, I did not.

PC: In that preprint, Professor Kac used a non-rigorous approach, which relies on an analytical continuation from the integers to the reals. (This approach is now known as the *replica trick*.) What was your impression of this approach? Do you know where Professor Kac had taken that idea from?

TFL: Unfortunately, no.

PC: How involved was Professor Kac with your work on this problem?

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[5] Henry P. McKean: https://en.wikipedia.org/wiki/Henry_McKean

[6] George Uhlenbeck: https://en.wikipedia.org/wiki/George_Uhlenbeck

[7] John F. Riordan: https://en.wikipedia.org/wiki/John_Riordan_(mathematician)

[8] See, *e.g.*, "Morris Schreiber 1926-1988," *News and Notes* **19**(5), 2 (1988). http://digitalcommons.rockefeller.edu/news_and_notes_1988/2 (Consulted September 18, 2022.)

[9] M. Kac, "On Certain Toeplitz-Like Matrices and Their Relation to the Problem of Lattice Vibrations," *Arkiv for Det Fysiske Seminar i Trondheim* No 11-1968 (1968). Reprinted as M. Kac, "On Certain Toeplitz-Like Matrices and Their Relation to the Problem of Lattice Vibrations," *J. Stat. Phys.* **151**, 785–795 (2013). https://doi.org/10.1007/s10955-012-0675-7

TFL: Professor Kac was, of course, a busy man. We had periodic discussions, and I would consult him when I ran into bottleneck. When I eventually worked this problem out in roughly six months of time, Professor Kac was very pleased and instructed me to write it down; after I gave him my first draft, he shortened it and added Appendix 3.

PC: What was the reception to your proving the equivalence of the approach of Professor Kac with that of Professor Dyson[10]?

TFL: I was unaware of any communications between Professors Kac and Dyson[11]. What I knew was that Professor Kac sent it *J. Math. Phys.* for publication[12].

PC: Did you get in touch with Professor Dyson, for instance?

TFL: No, I did not.

PC: The other work you did at Rockefeller was with Professor Gallavotti on a one-dimensional lattice gas model[13]. What can you tell us about the genesis of that work?

TFL: Professor Gallavotti was my officemate[14]. This model was one of the topics we had discussed.

PC: To the best of my knowledge, neither you nor Professor Kac has never used the *replica trick* again afterwards. Do you know of any particular reason?

TLF: I don't know why… I assume that at the time it was a little too novel (or immature) for mathematic modules to be applied to the physics field.

PC: Did you pay any attention to those who did?

TFL: No, I didn't.

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[10] F. J. Dyson, "The Dynamics of a Disordered Linear Chain," *Phys. Rev.* **92**, 1331 (1953). https://doi.org/10.1103/PhysRev.92.1331

[11] Freeman Dyson: https://en.wikipedia.org/wiki/Freeman_Dyson

[12] T.-F. Lin, "Problem of the Disordered Chain," *J. Math. Phys.* **11**, 1584 (1970). https://doi.org/10.1063/1.1665300

[13] G. Gallavotti and T.-F. Lin, "One Dimensional Lattice Gases with Rapidly Decreasing Interaction," *Arch. Ration. Mech. Anal.* **37**, 181–191 (1970). https://doi.org/10.1007/BF00281476

[14] Giovanni Gallavotti was a research associate in the Mathematics Department of the Rockefeller University, New York, during the academic years 1968-69 and 1969-70. https://www.roma1.infn.it/~gallavot/giovanni/gingl.html (Consulted September 18, 2022.)

PC: During your time at Rockefeller of elsewhere, did you ever teach or lecture about your work on disordered systems?

TFL: In some invited talks, I did talk about it. I talked about this problem at a mathematical conference at Sante Fe, New Mexico in the summer of 1970. I also talked about this problem at Academia Sinica[15], and National Taiwan University in Taiwan in 1972.

PC: Anything else you would like to share with us about this era that we may have missed?

TFL: At the Rockefeller University, Professor McKean taught a stochastic integrals class[16]; by attending this class I learned about stochastic integral which I considered one of the most important fundamental pieces to many later theories in the field.

PC: Do you still have notes/papers/correspondence from that epoch? If yes, do you intend to deposit them at an academic archive?

TFL: Unfortunately, no.

[15] Academia Sinica: https://en.wikipedia.org/wiki/Academia_Sinica

[16] See, *e.g.*, H. P. McKean, *Stochastic Integrals* (Providence, RI: American Mathematical Society, 1969).