International Journal of Modern Physics B

FA YUEH WU*

The current volume contains a collection of papers presented at the Nankai Symposium on "Lattice Statistics and Mathematical Physics," which was organized to honor the seventieth birthday of Professor Wu. This conference has taken place at the Nankai Institute of Mathematics in Tianjin, China, hosted by its Vice Director Professor Mo-Lin Ge, October 7–11, 2001, co-organized with APCTP and Beijing Normal University.

1. Brief Biography

Fa-Yueh Wu (a.k.a. Fred Wu) was born January 1932. He moved with his parents and the Chinese government throughout the Sino-Japanese war and the civil war from 1938 to 1949. It may be noted that he graduated from Nankai Junior High School in Chungking, making him an "alumnus of Nankai." After graduating from high school in 1949, he eventually moved with his parents to Taiwan.

There he entered the Chinese Naval College of Technology in 1949, obtaining a B.S. degree in Electrical Engineering in 1954, and receiving the commission as an Ensign in the navy.

Wu was sent by the Chinese navy to the U.S. in 1955 to receive training at the Naval School of Electronics in San Francisco and the Instructors' School in San Diego, returning to Taiwan in 1956 to teach Electronics at the Naval Academy. He was a full-fledged expert on radar and sonar at that time, with a skill he has found useful recently in resoldering and fixing his broken remote car key.

Fred Wu was (and probably still is) a good player of Chinese chess. He was a regional champion in Taiwan in 1951, and later the 1956 champion of all armed forces in Taiwan while a naval ensign. His favorite pastime in his graduate student years was to play chess "blind" with classmates while working on his homework. He has challenged the participants of the symposium to see if he is still as sharp as he used to be. But nobody took up the challenge.

The very next year, in 1957, he entered the graduate school of the National Tsing Hua University in Taiwan, obtaining an M.S. degree in physics two years later.

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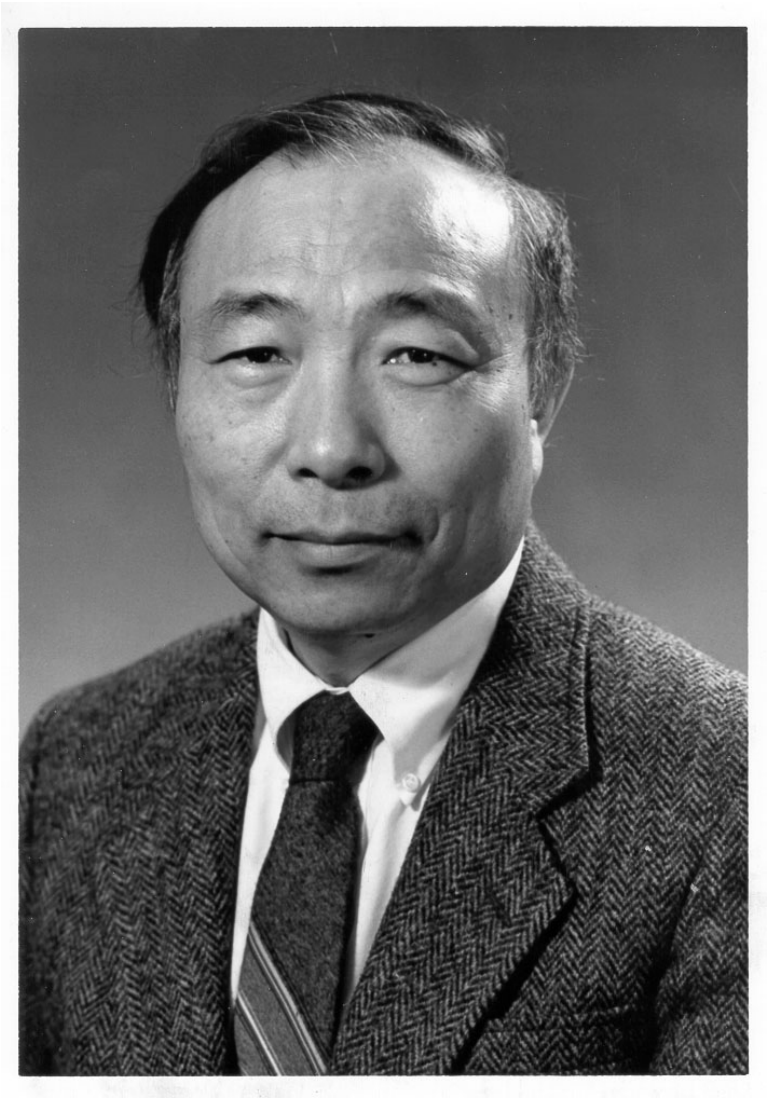

Fa-Yueh Wu

In 1959 he entered Washington University in St. Louis as a physics graduate student, where he studied under the late Professor Eugene Feenberg, working on many-body problems and obtaining his Ph.D. in physics in 1963. He taught for four years at Virginia Polytechnic Institute before coming to Northeastern University in 1967, where he is presently the Matthews University Distinguished Professor of Physics.

Wu has accumulated a publication list[a] of over 200 papers and monographs. His earliest paper is in Chinese and published by him in 1955 while an Ensign in the Chinese navy. This paper[1] bears the title "On the discussions of 'free waveforms'." While Wu is known mostly for his publications in statistical mechanics, his works on many-body problems, especially those on liquid helium, have also been influential for many years, see e.g. Ref. 3, which was part of his Ph.D. thesis research. He has even published one experimental paper[5] with the title "Four slow neutron converters."

Wu came to Northeastern to work with Elliott Lieb in 1967, and in 1968 they published a classic joint paper on the ground state of the Hubbard model.[11] This paper has become prominent in the theory of high-T_c superconductors. Anderson has attributed to it "predicting" the existence of quarks, in his Physics Today article on the Centennial of the discovery of electrons. Lieb and Wu also wrote a monograph on vertex models in 1970, which has become a principal reference in the field for decades.[30]

Since Wu came to the U.S. in 1959 as an ensign in the Chinese navy and was not decommissioned then, he was promoted in rank while a graduate student and a faculty member, eventually reaching the rank of Lieutenant in 1963. Therefore, much of his early work including the monograph with Lieb was done by a Lieutenant of the Chinese navy. Eventually, he could not be promoted further since for that he had to take an exam and the Navy was not sure whether he could pass it. He was later decommissioned from the rank of Navy Lieutenant in 1971. Thus the Chinese Navy saved a bunch of retirement benefits paid to retirees depending on the length of their service.

Wu has worked on a wide-range of topics in many-body theory and statistical mechanics, including contributions in lattice statistics, graph theory, combinatorics, number theory, knot theory, and the interrelation between these topics.

Wu's 1982 review on the Potts model is also well-known.[88] This paper has been receiving over a hundred citations for many years ever since it was published.[b] In 1992 Wu published another well-received review on knot theory.[153] Fred Wu has since been referred to as being "knotty" by Professor Lebowitz, which might be said to be a little "naughty" of Joel.

[a]This list has been appended and a selection of this work has been cited in the following, reflecting the taste of the present editor.

[b]In 1982, the year the Potts review was published, it was the fifth most-cited paper among papers published in all of physics according to E. Garfield, [Current Comments **48**, 3 (1984)].

2. Some other selected publications

Another classic is the paper on the Free Fermion Model.[16] This was later extended to its checkerboard version during one of Wu's many visits to Taiwan.[49,51] Fred Wu was a close friend of the late Professor Piet Kasteleyn, who was co-advising my thesis work with Professor Hans Capel in Leiden at the time. Kasteleyn noted the similarity of my first major paper[c] on the alternating XY-chain and the preprints of the above works. Both showed multiple phase transitions.

Well-known is also the Baxter–Wu Model, i.e. the Ising model with three-spin interactions on a triangular lattice.[44,48] Another classic paper, by Baxter, Kelland and Wu, concerns the graphical construction of the equivalence of the partition functions of the Potts model and a certain staggered six-vertex model.[56] Many people consider this construction easier than the algebraic method of Temperley and Lieb. Both methods are widely used these days. This paper is also at the basis of my first joint work with Fred Wu.[102] Here we generalized this equivalence to include the nonintersecting string (NIS) model of Stroganov and Schultz, alias the Close-Packed Loop Model.

The six-vertex model is boundary-condition dependent. However, Brascamp, Kunz and Wu established for the first time that at sufficiently low temperatures or sufficiently high fields the six-vertex models with either periodic or free boundary conditions are equivalent.[42]

Another remarkable result of Wu is that a very general staggered eight-vertex model in the Ising language (introduced in 1971 by Kadanoff and Wegner and by Wu[28] in two back-to-back papers), but with the special magnetic field $\mathrm{i}\pi k_{\mathrm{B}}T/2$ of Lee and Yang added, is equivalent to Baxter's symmetric eight-vertex model and hence solvable.[104] The general eight-vertex model without this field is not known to be solvable.

The dimer model on the honeycomb lattice was first solved by Kasteleyn. This has recently been generalized by Huang, Wu, Kunz and Kim to the case where the dimers have nearest-neighbor interaction.[172] This model relates to a degenerate case of the six-vertex model, requiring a special Bethe Ansatz analysis. The resulting phase diagram of this five-vertex model is quite complicated. This work has also been used in papers by Huang, Popkov and Wu on the three-dimensional dimer model.[175,180] Its phase diagram is also quite complex.

In 1999, Lu and Wu initiated work on dimer and Ising models on nonorientable surfaces,[191,200,202] and generalized a reciprocity theorem in dimer combinatorics due to R. Stanley and J. Propp.[203] There is now much activity in this area, inspired by this work, as there is much interest in finite-size corrections and conformal field theories on more complicated surfaces.

This is, of course, only a limited selection. A more precise understanding of the impact of Wu's work can be obtained by going over the following publication

[c] J.H.H. Perk, H.W. Capel, M.J. Zuilhof, and Th.J. Siskens, Physica A **81**, 319–348 (1975).

list and from the many papers in the volume. Therefore, I can speak on behalf of the other editor Professor Ge and the many participants of the symposium: Happy birthday and thank you, Professor Wu, for your many special insights and for being a friend of us all and not just a colleague.

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