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Neutron star news and puzzles

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Abstract

Gerry Brown has had the most influence on my career in Physics, and my life after graduate studies. This article gives a brief account of some of the many ways in which Gerry shaped my research. Focus is placed on the significant strides on neutron star research made by the group at Stony Brook, which Gerry built from scratch. Selected puzzles about neutron stars that remain to be solved are noted.

Keywords: Neutron stars; Observations; Theoretical insights

1. Memories of Gerry Brown (personal perspective)

Wolfram Weise, a long-time collaborator of Gerry's, came up to me after my talk at the meeting and said "Write exactly as you spoke". I will try to recollect what I said about Gerry during the meeting.

1.1. How it all began

My association with Gerry began in 1980 at the Niels Bohr Institute (NBI) in Copenhagen. Through Jakob Bondorf, Gerry had learned that I was spending most of my meagre Danish International Development Agency's (DANIDA) scholarship money calling my wife Manju, who was a physics graduate student in Columbia University, NY. From the front bench – during a traditional Monday morning seminar at the NBI – Gerry passed to me, in a rear bench, a yellow sheet of paper. The first sentence in his note offered me a post-doc position, and the second sentence instructed me to contact the administrator of the Nuclear Theory Group at Stony Brook University, Sydel Blumberg. It was signed, Gerry Brown. I was astounded!

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I later learned that he was the supervisory editor of Nuclear Physics A and read everything that was submitted to the journal. I had written a paper with Shalom Shlomo on Wigner distribution functions of nuclei, and Gerry had chosen Nandor Balaz, an expert on the subject, as the referee of our manuscript. Gerry's comment was "If you can pass through Nandor, you must be ok". Little did I know then that he had plans for me.

1.2. My early days with Gerry

I came to Stony Brook in the summer of 1981 and was put up at the Sunwood estate. I had no car, so I walked everyday to the Physics Department and then back to the "Golden Cage" at Sunwood. Gerry was at the NBI telling Hans Bethe what to work on (supernovae, I later learned). I gave my first talk on "Phase Space Distributions of Time-Dependent Hartree–Fock (TDHF) Collisons" to experimentalists in the basement of the Physics building. My talk, which Aage Bohr and Ben Mottelson had liked at the NBI, was a disaster at Stony Brook! I thought no one cared. The ever smiling and always kind Linwood Lee was my host, and made me feel that I was doing something useful and that I would be alright at Stony Brook.

With few people to talk to (post-docs Jochen Wambach, Berndt Schewizinger, and Rudolf Fiebig being busy with their own work), I started a collaboration with John Alexander (of the Chemistry Department) and Rich Friefelder (a physics graduate student doing experiments) on fission fragment angular distributions (of which I knew something from my Ph.D. work). Jochen kindly rented me a room in his house at 295 Sheep Pasture Road, which was less far to the Department than Sunwood. As I was getting somewhat settled, Sydel passed on a message from Gerry that I was to give a talk at MIT and I was to contact John Negele about my visit to MIT. The man was devious! Nervous as I was, I went to MIT, gave my talk, and was not seriously hurt – John was a kind host.

Gerry returned to Stony Brook in the fall, and was furiously at work on core-collapse supernovae, the little-bag model, Skyrmions, Fermi liquid theory, etc. To me, he said "you do too much numerical work (TDHF), start thinking!" He knew how to get under my skin. So I wrote a paper on "Effective masses in nuclei and the level density parameter" with Jochen Wambach and Mrs. Ma (a Chinese visitor) using only a calculator. The emphasis was on delineating the roles of the k-mass and the e-mass. I recall Claude Mahaux, editor of Physics Letters B, liking this paper. Gerry just nodded. Graduate students Jerry Cooperstein (Coop) and Eddie Baron, Professors Jim Lattimer and Amos Yahil, and post-doc Adam Burrows, and Hans Bethe, through his daily faxes, all working on supernova explosions, consumed Gerry's time to a great extent. He had me working on sub-threshold pion production, a topical subject at the time, but we were not satisfied with the results (not a large enough cross section for his taste). A little later, I worked with Peter Braun-Munzinger and Johanna Stachel using a different approach. We wrote a few papers together and got to know each other very well. Watching the excitement of the supernova gang, I asked him to give me a supernova-related project to work on. He said "You're doing very well on your own; I don't have to worry about you. Leave me alone". End of conversation. So I was just hanging around, helping Coop, Eddie, and Karen Kohlemainen (Lattimer's student) when I could.

Things turned around for me one day, when Gerry asked me to come to his house for morning coffee. The entire supernova gang was there. Gerry was fussing around Hans Bethe trying to make him comfortable. Reams of computer outputs from Stan Woosely were on the kitchen-cum-dining room table. Bethe started writing on a stand-up black board and said something about which Adam Burrows from the end of the room said "That's manifest nonsense!". Utter silence