Memories of Kerson Huang *(by Andrew J. Hanson)*

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Kerson Huang was my Ph.D. advisor at M.I.T. from around 1968 to 1971. In retrospect, I probably did not give much evidence of being a promising theoretical physics student. I had worked as an undergraduate and as a beginning graduate student in experimental high-energy physics, but was not really well-suited for that; after a year, I joined an aerospace group and worked for a while calculating design parameters for the Pugh-Schiff gyroscope experiment, a version of which finally flew in 2004 as Gravity Probe B. After a period of uncertainty and confusion, I had the quixotic idea that, in effect, "what was the point" if I did not attempt, and possibly fail at, the most difficult thing I could imagine, which at that time was theoretical elementary particle physics. I am not sure exactly what happened next, but at some point I suspect that David Frisch, who led my original experimental group and, along with Kerson, had been a Ph.D. student of Viki Weisskopf, advocated on my behalf and Kerson took pity on me, somehow finding the funds to support me in my quest to become educated as a theorist.

I recall that there was a tricky E&M problem on the written qualifying exam for which I got a nice-looking answer, but, when I proudly showed it to Kerson, he immediately noticed that I had missed a critical radiation term. However, my disappointment was assuaged later that day when I overheard him in a heated discussion with Ken Johnson, with the conversation going something like, "How *do* you calculate that?" My oral qualifier, the last barrier to my actually being allowed to try my hand at a dissertation, was no less amusing: Kerson and the committee sent me out into the hallway, as was customary, while they discussed my performance, but I did not know I was supposed to stick around for their verdict — so I slunk home, assuming I had failed and my theoretical journey was over. I was a bit shell-shocked when Kerson located me the next day and told me I had passed!

There were three or four of us working on our thesis research with Kerson at that point, meeting weekly in his office and working desperately to understand current papers and techniques we needed. Every once in a while, we had the special treat of seeing Kerson conducting a calligraphy demonstration in his office, all dressed up in ornate robes. But mostly we worked, and in these meetings we acquired a

realistic grasp of what theoretical physics actually is, with the critical instruction being Kerson's firmly worded feedback on what was or was not "a real calculation." Slowly our vague and imprecise concepts were beaten into shape under his intense oversight. While Kerson was publishing actively on his own research topics with other faculty members, he did not publish often with us, as clearly very little of what we were able to accomplish at that stage of our careers had yet become useful for him; I now know too well how long it can take to incubate a critical mass of knowledge even in a good student!

I moved forward on a dissertation that was essentially phenomenological, basically a practical matter of choosing a topic that I could actually finish in finite time. But my head was by now roaming elsewhere, deep in a vision of the role of geometry in physics, and I never published the thesis, and never again worked seriously on phenomenology. As I began thinking about postdoctoral opportunities, I caught the attention of Sergio Fubini, who encouraged my weird fascination with the relation of geometry and physics by connecting me with his friend Tullio Regge. Again, Kerson somehow converted an impossible dream to reality by his essential role in helping me get an NSF postdoctoral fellowship; that funding helped make it possible for me to actually go to the Institute for Advanced study to work with Regge, and also to spend a summer back at MIT to work on a seminal problem with Fubini and Jackiw.[1] Those magical years from 1971–1973 and several ongoing projects with Regge[2,3] were among the most inspiring times of my life.

The subsequent discovery of the first member of the ADE family of gravitational instantons[4] by myself (at LBL) and Tohru Eguchi (at SLAC) in 1978 grew naturally from the vast number of mathematical ideas I was exposed to in my post-doctoral experience. The work presented in my technical contribution to this volume follows from that era, building upon my varied career working not only in theoretical physics,[5] but also artificial intelligence, computer graphics, quaternions,[6] and mathematically accurate visualizations of such objects as Fermat surfaces and Calabi-Yau spaces.[7,8] The most fascinating steps leading up to the writing of this memoir were to happen after I graduated many of my own students at Indiana University in the field of mathematical and scientific visualization, and two of them went on to influential academic careers in Singapore and in Hong Kong. During a visit to Singapore to see my former student Philip Chi-Wing Fu, Philip made me aware that Kerson was a frequent visitor to the NTU Institute for Advanced Studies, and led a theoretical physics research group there with a couple of postdocs. We proceeded to introduce ourselves to Kerson's group (he was back in the U.S. at that moment), and it became apparent that we shared some common interests. We began discussing the issues involved in producing challenging graphics related to the cosmological and fluid dynamics problems that they were working on with Kerson, and a collaboration began[9] involving Kerson's group, Philip, and Philip's post-doctoral student Xiaopei Liu. Liu had just arrived at NTU after getting his Ph.D. from CUHK faculty member T. T. Wong, who got *his* Ph.D. from my own

first doctoral student, Pheng-Ann Heng! Kerson's post-doc Chi Xiong, in turn, was the one who invited me to participate in this commemorative volume honoring Kerson. In Figure 1, I trace Kerson's remarkable academic genealogy, and its trail through *twelve* generations of scientists.

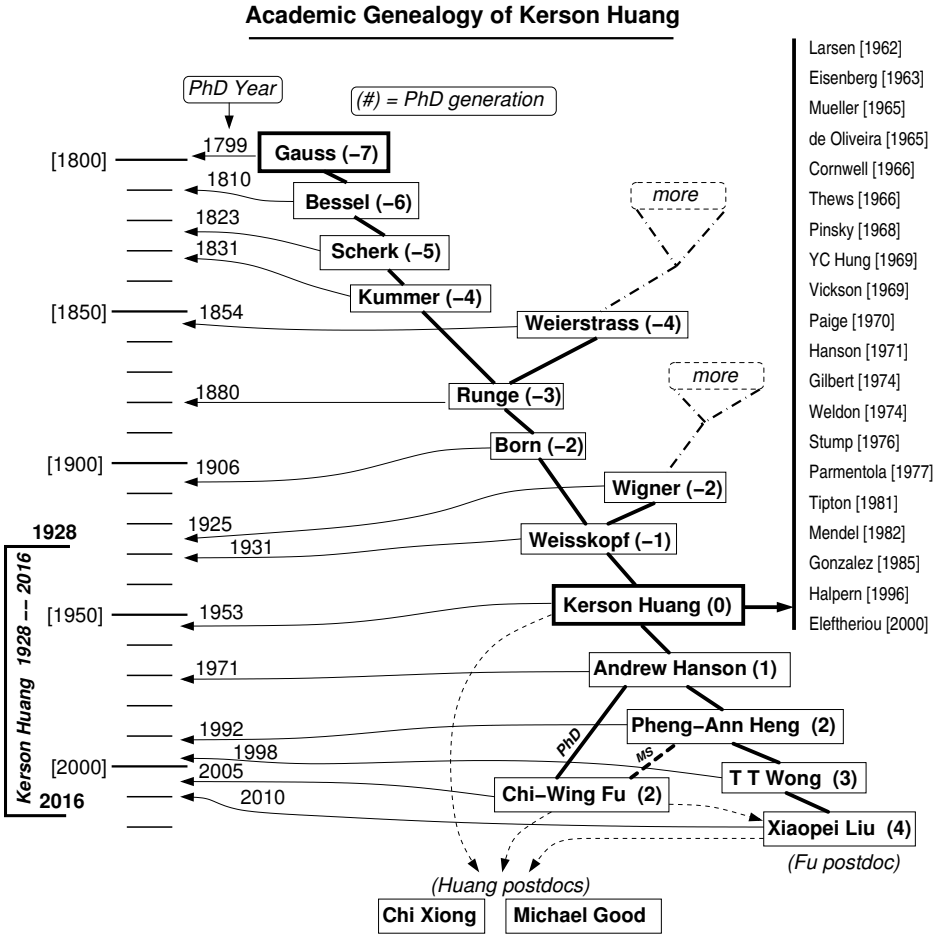

Fig. 1. Twelve generations of Kerson Huang's academic genealogy chart, along with the list of his own 21 doctoral students. Seven generations of doctoral degrees lead from Carl Friedrich Gauss through Max Born and Eugene Wigner to Kerson's Ph.D. at M.I.T. with Victor Weisskopf. Labeling Kerson himself as generation zero, Gauss is generation -7, I am generation +1, and a chain of my own doctoral students with three generations leads to NTU in Singapore, where Kerson led an active physics research group through his last days. In Singapore, we brought together Kerson's group, including his post-docs Chi Xiong (who invited me to write this article) and Michael Good, and my own academic descendants who were in the NTU School of Computer Science and Engineering. This collaboration included two generations of my own students, Prof. Chi-Wing Fu, generation +2, and his postdoc Xiaopei Liu, generation +4, who received his degree from T.T. Wong, who received *his* Ph.D. from Pheng-Ann Heng at CUHK in Hong Kong, Prof. Heng being the very first of my own doctoral students at Indiana University. Dr. Liu is thus Kerson's academic *great-great-grandchild*. This is a wonderful and amazing web of academic connections through both time and space. (Source: *The Mathematics Genealogy Project*: `https://genealogy.math.ndsu.nodak.edu/`)

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