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A Laudatio for Elliott Lieb on His Receiving the Poincaré Medal at the International Congress on Mathematical Physics in Lisbon, July 30, 2003

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It is truly a pleasure to be here and to participate in this celebration of Elliott Lieb's contributions to mathematical physics, for which he is being honored today with the Poincaré Prize. It is also a challenge to say something about Elliott's work which is not already known to most of you. Many of Elliott's papers are already classics and he has not even reached the age of 71 yet. He will not do that before midnight. But I think it's not too early to wish him a happy birthday. So please join me in saying, "Happy Birthday, Elliott! We certainly hope that you will continue for many many years to be vigorous and productive, adding luster to our field as you have done for the last half century."

I first met Elliott about forty years ago. It was at a Spring meeting of the American Physical Society which at that time always took place in Washington. The theoretical physics community in the US was still quite small then. There was no e-mail, no preprint archives or faxes, and a telegram or a long distance phone call was just for special occasions. The annual spring meeting in Washington was therefore a place to find out what was new in the field. This information was generally communicated in sessions consisting of about a dozen or more 10 minute talks. It was at one such meeting where I first heard Elliott talk. I believe it was about the interacting Bose gas, a subject to which Elliott has made, and continues to make, outstanding contributions. These include exact solutions of model systems, starting with his work with Liniger on bosons with repulsive delta function interactions, and exact results about realistic systems. He is still

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going strong with very recent work with Seiringer and Yngvason. In fact, if Elliott had done nothing else beside Bose systems he would already be an outstanding member of our community but, of course, that is only a small fraction of his contributions.

I was immediately very impressed by this obviously brilliant young man and I have continued to be impressed by him ever since. After the session, Elliott spoke to the chairman of the session, who was obviously also very impressed, about getting a job at Bell Labs. This was the place where Phil Anderson, who was supposed to be chairing that session, was working at that time. It turned out however that there had been a substitution and the actual chair was Elliott Montroll, who was just then in the process of moving to IBM. Montroll hired Elliott on the spot.

That led to Elliott's moving to a community just north of New York City, a move which facilitated my getting him to join me at Yeshiva University, located in the northern part of Manhattan, a few years later. At Yeshiva I had a chance to savor Elliott's brilliance up close, and also to benefit from it directly by working with him. It also led to a friendship which, despite various stresses along the way—as many of you know, Elliott has strong principles and it is not always easy to live up to them—has endured for over forty years. For all of this I am most grateful to Elliott.

While at IBM, Elliott did some very beautiful work with Dan Mattis and others on spins and magnetism in quantum systems, including the book with Mattis, "Mathematical Physics in One Dimension." As Elliott put it later at a conference at Stony Brook in 1966: "I wasn't born one dimensional, I just grew that way."

Meanwhile Elliott had left Yeshiva University, after getting several speeding tickets while driving there from his home in Westchester to teach his classes, and being threatened with the loss of his driver's license. He joined the faculty of Northeastern University and immediately went into a burst of creative activity with his exact solution of the ice problem.

I still remember when I first heard about this result. I was having breakfast with Elliott at a luncheonette, sitting at the counter on round swivel stools (those of you who don't know what a luncheonette is, or was, and probably have never had a chocolate egg-cream, please see me later). While I was having my scrambled eggs, Elliott started telling me about the problem of the residual entropy of ice, Pauling's approximate solution of the six-vertex model of "square ice," and Elliott's exact solution of the problem via the Bethe Ansatz. That solution still stands, alongside Onsager's solution of the two dimensional Ising Model and Baxter's later work on the eight-vertex model, as one of the very high peaks in equilibrium statistical mechanics. It was truly breakthrough work.

I see time going fast and I am only in the year 1967. Still to come are Elliott's brilliant work on Coulomb systems (in which I was also a participant), and on quantum mechanical entropy with Mary Beth Ruskai and others, which took up some of Elliott's time during the next five years. Meanwhile Elliott moved from Northeastern to MIT.

Then came the transition to Princeton, the beautiful work with Brascamp on the famous inequalities; the work with Thirring and others on Coulomb systems, atoms, and molecules; the work with Froehlich, Simon, Aizenman, Dyson, Sokal and many others on lattice systems; the inequalities for the number of bound states in quantum systems, and other Lieb inequalities, as well as some individual and some joint work with Almgren, Brezis and others. His accomplishments are really too many to try to enumerate here and I haven't even come yet to the modern era, beginning in 1981, when Elliott began to work on Thomas—Fermi theory, stability of atoms in strong magnetic fields, and many, many other difficult problems. But time has run out, so again: Happy Birthday, Elliott!