Laudatio for Elliott Lieb, Lisbon, July 30, 2003

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 Poincare Prize. It is a challenge to say something about Elliott's work which is not already well known to you. Many of Elliott's works are already classics. If evidence of this is needed it is shown by his Selecta "The Stability of Matter" already being in the third edition, - and he is still going strong.

I thought therefore I would just read you something from Freeman Dyson's preface to the first edition of Elliott's Selecta: "With this book, Elliott Lieb joins his peers Herman Weyl and C. N. Yang... Each of them enriches both physics and mathematics by finding new mathematical depths in the description of familiar physical processes... The central theme of Lieb's papers collected in this book is the classical Thomas-Fermi model of an atom, linking the physical stability of matter with the mathematics of functional analysis.

This may be a good time to mention the wonderful book "Functional Analysis" by Lieb and Loss and the second volume of Lieb's Selecta "Inequalities" edited by Michael Loss and Mary Beth Ruskai.

Elliott got his PhD degree in Birmingham, England where he went to study after finishing college at MIT. He was in Peierls' group but his thesis advisor was Sam Edwards. Even at that time Elliott already had very strong opinions and was no respecter of authority. According to Sam Edwards, Elliott came to him one day and told him that there was a wrong sign in one of Maxwell's equations. Sam didn't argue with him, he just waited until Elliott figured it out for himself.

Continuing in a personal vein, let me say that I first met Elliott about forty three years ago at a Spring meeting of the American Physical Society, which at that time always took place in Washington. The physics community in the US was still quite small then. There were no e-mail, preprint archives or faxes, and a telegram or a long distance phone call was for special occasions. If you were just informed that you got the Poincare or Nobel Prize, you would telephone your mother or send her a telegram. The annual spring meeting in Washington was therefore a place to find out what was new in physics. This information was generally communicated in sessions consisting of about a dozen or more ten minute talks. It was at such a session where I first heard Elliott talk. I believe it was about the hard sphere Bose gas, a subject in which Elliott has made and continues to make outstanding contributions.

These include exact solutions of model systems as in his work with Liniger on Bosson with repulsive delta function interactions and exact results about realistic systems.

Elliott is still pursuing this field vigorously with his very recent work with Solovej, 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 work is only a small fraction of his contributions, less than ten percent of his papers. But then, this could also be said about many other fields in which Elliott has worked.

I was immediately very impressed by this obviously brilliant young man and I have continued to be impressed by him ever since. As an aside: after the session Elliott spoke to the chairman of the session, who was obviously also very impressed, about getting a job at Bell Labs 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 then just in the process of moving to IBM. (He hired Elliott on the spot.) That switch led to Elliott's moving to a community just north of New York City which facilitated my getting him to accept a position at Yeshiva University a few years later. That gave me 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, has endured for over forty years. For all of this I am most grateful to Elliott.

While at IBM Elliott spent some time teaching science in Sierra Leone as a good will ambassador. He also did some very beautiful work with Dan Mattis and others at IBM on magnetism in quantum systems. To that period also belongs 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 he had received several speeding tickets driving from his home in Westchester to Yeshiva University and was being threatened with the imminent loss of his drivers 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 rotating

stools (For those of you who don't know what a luncheonette is, or was, and probably have never had a chocolate egg-cream, too bad). While I was having my scrambled eggs, Elliott started telling me about the residual entropy problem of ice, Pauling's approximate solution of the six-vertex model of "square ice", and his own exact solution of the problem via the Bethe Ansatz. Talk of great work! That solution still stands alongside Onsager's solution of the two dimensional Ising 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), 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 and from MIT to Princeton.

Then came the beautiful work with Brascamp on the famous inequalities;the work with Thirring and others going from bare Coulomb systems to atoms and modelcules; the works with Froehlich, Simon, Aizenman, Dyson, Sokal and many others on lattice systems, the inequalities on the number of bound states and other Lieb inequalities; some individual, some joint work with Almgren, Brezis, and others too numerous to mention here.

Now comes the modern era, beginning in 1981, on Thomas-Fermi theory, stability of atoms in strong magnetic fields, etc. You have already heard about some of this work in the talks, by Solovej, Carlen, Seiringer and others.

Let me end by noting that Elliott will have a birthday tomorrow. I think it's not too early to say "Happy Birthday" to Elliott. So please join me in saying, "Happy Birthday, Elliott. We wish you to continue for many, many years to be vigorous and productive, adding luster to our field as you have done for the last half century."

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