

My Lamb Award Address, Snowbird, January 7, 2008

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It is quite obvious that I am honored, touched and grateful by this meritorious award, whose recipients have included some of the most illustrious names in laser physics and quantum optics. Yet to me this festive occasion is also a moment of reckoning.

One of the most widely quoted sayings in Jewish Ethics is by Rabbi Akaviah, probably 2<sup>nd</sup> century BC: “Consider: whence to you come, whither do you go and to whom are you accountable?”. I am inclined to consider the first two questions on this occasion.

Whence do I come (Table 1)? My origins are very humble. The big leap in my family was when Soviet authorities not only saved my parents from Nazi extermination but also gave them access to higher education, unaffordable in Pre-War Poland. The shaping event of my life was the exit from the Soviet Union in 1958 and the subsequent move of our family to Israel, motivated by Jewish national feelings. Thereafter, I can discern four influences in my life: 1) my upbringing as child and domestic life as adult in a cultural climate that had been an amalgam of Russian, Yiddish and Hebrew influences, in a family that cherished humanities and sciences alike; 2) the Technion, where I was privileged to learn physics from such first-rate scientists as Asher Peres and Nathan Rosen; 3) my military service that taught me the art of dedication to the objective combined with flexibility as to the means; 4) my Ph.D. studies with Marlan Scully at the University of New Mexico.

The answer to the question “whence do I come?” largely involves my scientific pedigree, of which I am proud (Table 2); I am a direct descendant of W. Lamb, just like my friend Wolfgang Schleich, my co-awardee. Through my Technion studies, I am a descendant of A. Einstein (through N. Rosen). Yet my dominant role model to this day, as scientist and man, has been my mentor Marlan Scully. I may summarize his influence on me as follows: (i) be bold and daring scientifically; (ii) be loyal to your coworkers. How often are these maxims forgotten! Marlan Scully epitomizes both.

My answer to Akaviah’s question “whither do you go?” as a scientist requires the definition of the grand scheme to which my endeavors belong. I define this grand

scheme as follows: what does quantum mechanics teach us about the World? To me, three issues stand out in this respect (Table 3):

a) The question of Being: Parmenides the Greek (5<sup>th</sup> Century BC) viewed Being as immutable. By contrast, Nagarjuna, the Indian-Buddhist skeptic (2<sup>nd</sup> Century), dismissed Being and Non-Being alike as meaningless. Quantum mechanics offers, intriguingly, something in-between these two extremes. The superposition principle allows for the possibility “to be and not to be” at the same time. I call this “quantum Hamletism”: it is exemplified by Schroedinger’s cat paradox. I believe that human logic has not yet fully grasped this notion and its implications merit further study.

b) The question of change: Zeno, Parmenides’s disciple (ca. 460 BC) maintained that change and motion are mere illusions. I have devoted great efforts to the question: is change avoidable and reversible in quantum systems and is this the key to bridging the gap between quantum and classical dynamics?

c) Why should we try to understand quantum mechanics at all? In this respect I am influenced by a Jewish philosophical tradition that rests on both religious and scientific foundations: (i) Its founder was Rabbi Moses Maimonides (12<sup>th</sup> Century), who made physics, the study of the Universe, the foremost religious duty: the endeavor to fulfill the First Commandment by comprehending God’s manifestations in the World. The interpretation given by Maimonides to Jeremiah 9, 23, as to God’s rapport with the World is thoroughly scientific and can hardly be disputed by modern science (Table 3). (ii) Its greatest champion was Baruch Spinoza (17<sup>th</sup> Century), who, although austercized as heretic by his fellow Jews, was nonetheless a great believer and, most likely, a follower of Maimonides. His geometrical-logical “theory of everything”, stipulated that the single substance in the World is “God, namely, Nature”, with many modes and an infinity of attributes. Spinoza saw true redemption in the intellectual love of God, fulfilled by comprehension of the Universe. Einstein was a foresworn admirer of Spinoza’s teachings and personality. In an attempt to put Spinoza’s lofty ideas in quantum mechanical terms, I have drawn parallels between his modes and attributes, on the one hand, and quantum states and representations on the other (see my article in the book “Mind and its Place in the World”, Ontos Verlag, 2006).

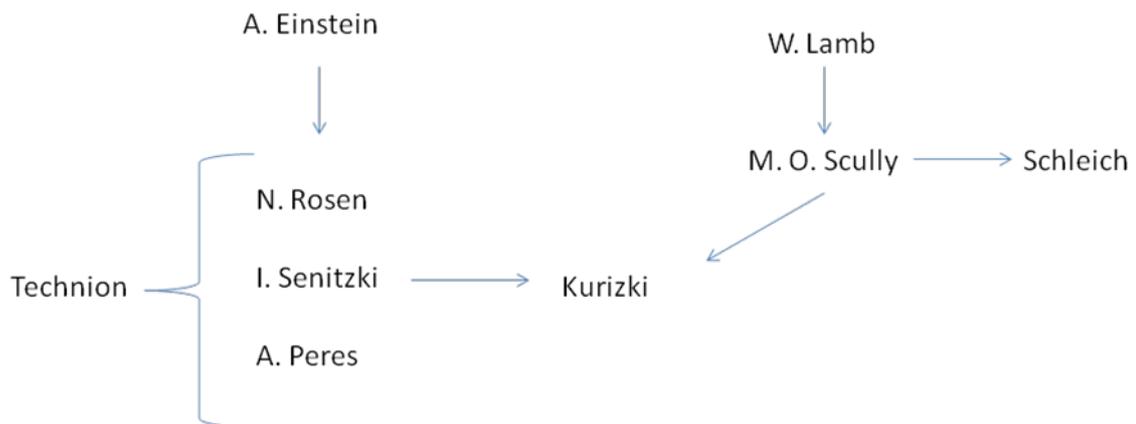
There is still much to be done towards understanding the enormously rich and profound language made available by quantum mechanics not only to physics but to logic, metaphysics and perhaps beyond them. I believe that even modest

contributions to this edifice may fully vindicate one's scientific toil. The greatest gratification to me may be that younger scientists embrace this undertaking. Thank you very much again!

**Table 1.** Whence do I come?

1790-1900	-	Ancestors: Jewish chicken farmers, Lithuania
1885-1942	-	Grandfather: Cobbler in Vilnius (Vilno), Poland
1919	-	Father: Civil engineer, educated in USSR
1927-1998	-	Mother: Physician, educated in USSR
1952	-	I am born, Vilnius, USSR
1958	-	Family leaves USSR for Israel
1960-1970	-	School days
<u>Family culture:</u> Amalgam of Russian, Yiddish, Hebrew, Sciences & Humanities		
1970-1974	-	Technion (B.Sc., M.Sc.)
1974-1979	-	Israel Defence Forces (Major)
1977	-	Marriage to Zipora (2 sons)
1980-1985	-	UNM (Ph.D.)
1983-1985	-	Tel-Aviv University (Lecturer)
1985	-	Weizmann Faculty
1990	-	Professor, QO Chair

**Table 2.** Pedigree



**Table 3.**

Whence do we come?	Whither do we go?
<ul style="list-style-type: none"> <li>• Parmenides (5<sup>th</sup> BC): “What is -- is, what is not -- is not”</li> </ul>	
<ul style="list-style-type: none"> <li>• Nagarjuna (2<sup>nd</sup> C): “<u>Is</u>, is <u>not</u> -- meaningless, reality is empty”</li> </ul>	<ul style="list-style-type: none"> <li>• QM: To be <u>and</u> not to be?</li> </ul>
<ul style="list-style-type: none"> <li>• Zeno (5<sup>th</sup> BC): “Change and motion -- illusions”</li> </ul>	<ul style="list-style-type: none"> <li>• QM: Is change avoidable? Reversible?</li> </ul>
<ul style="list-style-type: none"> <li>• Moshe Maimonides (12<sup>th</sup> C): “First commandment is to know God through the Universe” (Physics=religion). Interprets Jeremiah 9,23: “I am the Lord who exercise <u>mercy</u> (=creation), <u>Justice</u> (=natural law), and <u>righteousness</u> (=free will)”.</li> </ul>	
<ul style="list-style-type: none"> <li>• Baruch Spinoza (17<sup>th</sup> C): One substance=God=Nature, many modes, infinity of attributes. Redemption=Intellectual love of God = Comprehension</li> </ul>	<ul style="list-style-type: none"> <li>• “QM of everything”: Modes of existence=eigenstates. Attribute=Basis. (G. Kurizki, in “Mind and Place in the World”, Ontos Verlag, 2006)</li> </ul>
<ul style="list-style-type: none"> <li>• Einstein:Spinozicist</li> </ul>	