

## **The cat who walked by himself**

Distinguished Professor Asher Peres was born Aristide Pressman in 1934 to Shlomo (Solomon) and Shulamit (Salomea), Jewish émigrés from Lemberg (today Lviv), in Beaulieu-sur-Dordogne, France. The family was deported to Poland soon after Asher's birth but, fortunately, was allowed to return to France shortly before the outbreak of the Second World War. After the fall of Paris the family fled to Asher's birthplace in the Dordogne to hide from the Nazi regime. Following the exposure of their Jewish identity by local anti-Semites and extortion attempts, Asher's father joined the Résistance. Mother and son then moved from one village to another in search of hiding. After the liberation of France, Solomon was decorated by the French Republic for his service in the Résistance. Asher's experiences during the war were related by him in a moving document entitled *I Am The Cat Who Walks By Himself \**, after Rudyard Kipling's tale.

In 1949 the family immigrated to Israel and Asher was welcomed at the port, among other immigrants and survivors of the concentration camps, with a shower of the insecticide DDT. He began his studies at the Technion in 1952. His father, a down-to-earth electrical engineer, told Asher: "don't study EE because it's boring, and don't study Physics because you'll get no job". The wunderkind then enrolled in the Department of Mechanical Engineering. Asher was an unusual student who was encouraged not to attend classes. In fact, one of his math professors promised to give him the highest grade on the condition that he not attend his lectures. This was after Asher spotted an embarrassing error in a proof. Asher wrote his first article in theoretical physics as a second-year undergrad in mechanical engineering. The article was received for publication in the Comptes Rendu by Louis de Broglie .

At about the same time the physics department at the Technion got a major boost in the person of Nathan Rosen, the R of the Einstein Podolsky Rosen gedanken experiment, who joined the faculty. The first contact between the two occurred when Nathan lent Asher Tolman's book on general relativity, a book that Asher could not find in the library of Mechanical Engineering. In time, Asher became Nathan's graduate student and wrote his PhD under his supervision in 1959. While supervisor-student relations are occasionally strained by mixed feelings, in the case of Nathan and Asher the association led to a lifelong mutual admiration, respect and love. Asher requested to be buried next to his mentor.

For his thesis Asher calculated the emission of gravitational waves from an orbiting star. Gravitational waves are a central component of the general theory of relativity and although the decreasing period of a binary pulsar system gives indirect experimental proof of their existence, antennas that are sensitive enough to measure them directly are only now being

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built. Making a precise calculation of gravitational radiation from astrophysical sources is a topic of much current interest because of its relevance to the LIGO project currently under way and the planned LISA space-based gravitational wave observatory.

Asher joined the faculty of the Technion upon his graduation and was rapidly promoted to Full Professor. He was appointed Distinguished University Professor in 1988.

Asher worked on a remarkably wide range of problems ranging from practical problems to visionary and foundational issues. He was a master of turning vague questions into concrete, decidable and well defined mathematical problems. And, of course, solving them. Asher's first graduate student, Ira Aviram, wrote his thesis on nuclear reactor theory. Asher had a lasting love affair with classical and quantum mechanics which naturally led to his involvement in quantum chaos. His work with another graduate student, Mario Feingold, on the statistical properties of matrix elements of chaotic systems, led to what is now known among mathematicians as the Feingold-Peres conjecture and among physicists the Feingold-Peres theory. Asher was fond of making computations. He was proud, and derived much pleasure from the fact, that he plotted complicated Poincare sections of chaotic dynamical systems, not like everybody else by programming a computer, but, in his own way, by programming his postscript printer. Doing things in his own unique way was a characteristic of Asher.

Asher's greatest impact in theoretical physics was in the foundations of quantum theory and the theory of quantum information. Asher became one of the leaders of the quantum information revolution. He is among the six co-authors of the 1993 paper introducing quantum teleportation, in which it is shown that a quantum state can be conveyed from place to place by a combination of entanglement and classical communication, despite the fact that a direct measurement would destroy the state. And indeed, teleportation of small systems has now been demonstrated experimentally by a number of groups. When a reporter once asked Asher if quantum teleportation would be able to teleport Scotty's soul too, Asher answered, characteristically, No, not the body, just the soul.

Another of Asher's important contributions to quantum information is the formulation of a criterion to decide whether two particles are entangled. Roughly speaking, if conceptually reversing the direction of time for just one of the particles results in a non-physical situation with negative probabilities, the two particles are entangled. This criterion is a basic tool in deciding whether two photons that come from a cascade are indeed entangled or just mixed with classical correlations. Asher's last two students, Netanel Lindner and Petra Scudo, worked on quantum information and in particular, on problems associated with communicating the notion of direction and frames using quantum particles.

Asher coined phrases that have become part and parcel of the quantum community, such as –

Unperformed experiments have no results.

Quantum phenomena do not occur in a Hilbert space, they occur in a laboratory.

Quantum mechanics needs no 'interpretation'.

Never underestimate the ingenuity of experimental physicists!

Asher's book, *Quantum theory: Concepts and Methods*, is a wonderful book on quantum mechanics and quantum information. It is, arguably, the modern successor of J. von Neumann's book on the foundations of quantum mechanics. And, as the title promises, it strikes a remarkable balance between conceptual issues and concrete computational techniques. For anyone who wants to know what a quantum measurement is; when a theory is counterfactual; what hidden variables have to do with cryptodeterminism; or to find out about Bell inequalities and the role of an ancilla, this is the place to learn it.

Asher was a man of principles and a person with a keen sense of humor. One of his principles was that he did not like the uncertainty principle. In the index to his book the uncertainty principle in the index refers to page 445. This is the page of the index. A reader in search of the uncertainty principle enters a loop that does not terminate.

Asher was a graceful lecturer and a brilliant and witty teacher. He was an original scientist, profound and clear, who broke new ground in uncharted territory. He feared none and did not aim to please. In 1983, while chairman of the physics department at the Technion, he created a political mini-scandal, when he publicly proposed the then Israeli Prime Minister, Menachem Begin, for the Nobel Prize in Physics. Those were the days of the Israel-Lebanon war. As a justification, Asher said that Begin deserved the Nobel Prize for physics as much as he deserved the Nobel Prize for peace (which he had shared with Anwar Sadat). The prime minister's office did not appreciate the humor and the Technion president felt that he needed to apologize to the Swedish Academy, whose response was that they feared the Technion president may have lost some of the spirit of good Jewish humor. Asher was a proud man who had little respect for power and in particular for (military and otherwise) funding agencies.

Asher was a concerned citizen who filled many central roles in the Technion: he served as Dean of the Graduate School, led major structural changes in the undergraduate school of the Technion and reformed the libraries. He also brought the first Xerox machine to the Technion in spite of the grumbling of the administration who could not understand what business physics had to start its own printing shop.

Asher is survived by his wife Aviva, his two daughters, Lydia and Nomy and six grandchildren.

חבל על דאבדין ולא משתכחין

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