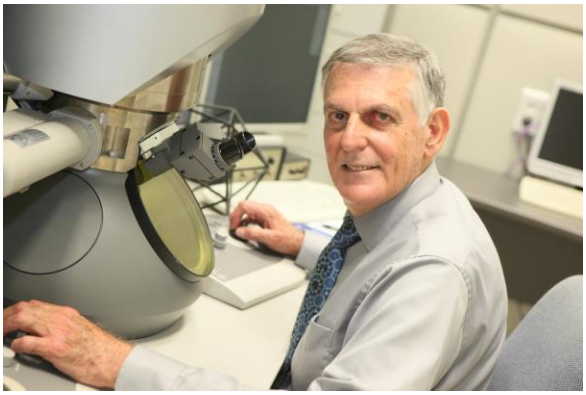
The 2014 Jerome B. Cohen Distinguished Lecture Series



Dr. Dan Shechtman – Nobel Laureate

Israel Institute of Technology

Tuesday, October 21, 2014
4:00pm, Tech LR3
Reception to follow in Willens Wing

"Quasi-Periodic Crystals – A Paradigm Shift In Crystallography"

Crystallography has been one of the mature sciences. Over the years, the modern science of crystallography that started by experimenting with x-ray diffraction from crystals in 1912, has developed a major paradigm – that all crystals are ordered and periodic. Indeed, this was the basis for the definition of "crystal" in textbooks of crystallography and x-ray diffraction. Based upon a vast number of experimental data, constantly improving research tools, and deepening theoretical understanding of the structure of crystalline materials no revolution was anticipated in our understanding the atomic order of solids.

However, such revolution did happen with the discovery of the Icosahedral phase, the first quasi-periodic crystal (QC) in 1982, and its announcement in 1984 [1, 2]. QCs are ordered materials, but their atomic order is quasiperiodic rather than periodic, enabling formation of crystal symmetries, such as icosahedral symmetry, which cannot exist in periodic materials. The discovery created deep cracks in this paradigm, but the acceptance by the crystallographers' community of the new class of ordered crystals did not happen in one day. In fact it took almost a decade for QC order to be accepted by most crystallographers. The official stamp of approval came in a form of a new definition of "Crystal" by the International Union of Crystallographers. The paradigm that all crystals are periodic has thus been changed. It is clear now that although most crystals are ordered and periodic, a good number of them are ordered and quasi-periodic.

While believers and nonbelievers were debating, a large volume of experimental and theoretical studies was published, a result of a relentless effort of many groups around the world. Quasi-periodic materials have developed into an exciting interdisciplinary science.

This talk will outline the discovery of QCs and describe the important role of electron microscopy as an enabling discovery tool.

[1] D. Shechtman, I. Blech, Met. Trans. 16A (June 1985) 1005-1012.
[2] D. Shechtman, I. Blech, D. Gratias, J.W. Cahn, Phys. Rev. Letters, Vol 53, No. 20 (1984) 1951-1953.

Biography: Dan Shechtman was born 1941 in Tel Aviv (Israel). After receiving his Ph.D. in Materials Engineering from the Technion in 1972, where he also obtained his B.Sc. in Mechanical Engineering in 1966 and M.Sc. in Materials Engineering in 1968, Prof. Shechtman was an NRC fellow at the Aerospace Research Laboratories at Wright Patterson AFB, Ohio, where he studied for three years the microstructure and physical metallurgy of titanium aluminides. In 1975 he joined the department of materials engineering at Technion. In 1981–1983 he was on Sabbatical at Johns Hopkins University, where he studied rapidly solidified aluminum transition metal alloys, in a joint program with NBS. On April 8, 1982, Shechtman discovered the icosahedral phase, which opened the new field of quasiperiodic crystals. In 1992-1994 he was on sabbatical at National Institute of Standards and Technology – NIST (formerly NBS), where he studied the effect of the structural defect of CVD diamond on its growth and properties. Shechtman's Technion research is conducted in the Louis Edelstein Center, and in the Wolfson Centre which is headed by him. He is the Philip Tobias Distinguished Professor of Materials Science at the Technion, Israel Institute of Technology, an Associate of the US Department of Energy's Ames Laboratory, and Professor of Materials Science at Iowa State University. He was awarded twelve international and Israeli prizes including the Wolf Prize and the Aminoff Prize. In 2011 he received the Nobel Prize in Chemistry for "the discovery of quasicrystals". Shechtman is the fourth Israeli to win the Nobel Prize in Chemistry in under a decade. He is married to Prof. Zipora Shechtman, and has a son and three daughters. In his many lectures around the world Shechtman advocates education and in particular science education from early age as well as Technological Entrepreneurship as key to world peace and prosperity.