Bell Laboratories Scientist Named Nobel Laureate

Philip W. Anderson, consulting director in the Physical Research Division at Bell Labs, Murray Hill, and a Professor at Princeton University, has been named one of three joint recipients of the 1977 Nobel Prize in Physics.

Anderson shares the award from the Royal Swedish Academy of Sciences with John H. Van Vleck of Harvard University and Sir Neville Mott of Cambridge University, England.

According to the Academy, "The three prize winners are theoreticians within the field of solid state physics, the branch of physics which lies behind current technical developments, particularly in electronics."

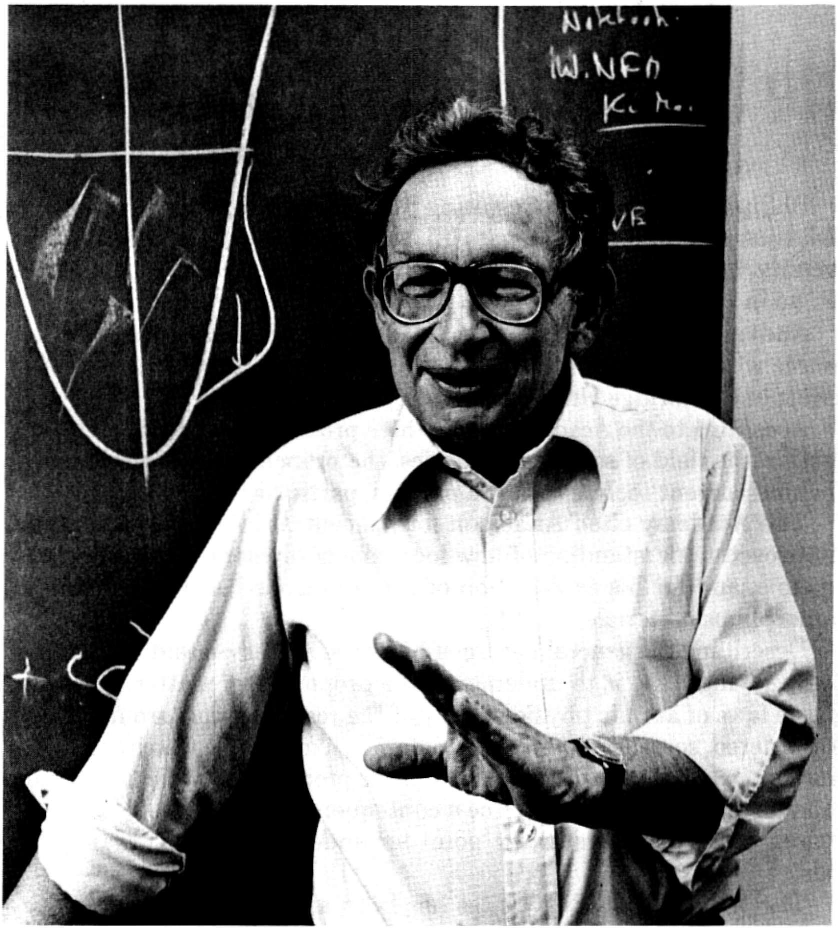
The Academy cited Anderson for his central role in developing an improved understanding of how local magnetic moments can occur in metals, and for his explanation of how electrons become localized in amorphous materials.

Describing the general nature of his work, Anderson said, "What I've been trying to do is to understand the properties of matter, given the basic laws of atomic physics. Many of the real materials around us are disordered, so-called amorphous materials like glass, in which the atoms have no regular arrangement. Many of the properties that we understand about solids are supposed to be a consequence of that regular arrangement. So we had no starting point for understanding disordered solids.

The work the Academy cites has been a starting point for understanding how electrons move in irregular solids. It consists of classifying two kinds of situations: One in which the electrons can move freely in the whole of the material and the other in which the electrons are pinned down, or localized, in one particular place.

Anderson's work resulted in a better understanding of why certain atoms such as iron are magnetic when dissolved in nonmagnetic host metals, why other atoms that might be expected to be magnetic are not, and why certain amorphous materials (such as glass) do not conduct electricity.

In 1958 Anderson published a paper in which he showed under what conditions an electron in a disordered system can either move through the system as a whole or be more or less tied to a specific position as a localized electron. This paper, according to the Royal Swedish Academy, "has become one of the cornerstones in our understanding of, among other things, the electronic conductivity of disordered systems." These



Philip W. Anderson in his office at Bell Laboratories, Murray Hill, N.J.

ideas, the Academy said, "have been experimentally verified and they have in this way laid the foundations for important technical developments."

Explaining further, Anderson said, "One example that particularly interests me is window glass; everyone knows that ordinary window glass is a good electric insulator. It's not a metal. It doesn't conduct electricity well and is used for insulators in power lines and things like that. If you look at the reasons in standard physics textbooks for why a substance like glass is an insulator, you won't find answers. This is because these materials all depend on the irregularity of the structure, and glass is a totally irregular structure. You need this concept of localization to understand something as simple as window glass being an insulator."

Anderson also was cited by the Academy for his contributions to the basic understanding of local magnetic phenomena. One emerging practical application of this theoretical work is increasing use of magnetic materials in telecommunications systems and commercial computers.

Explaining the relationship of his work to bubble technology, Anderson said, "I was part of the group many years ago that worked in magnetism at Bell Laboratories. The Bell Labs group was a codiscoverer of the garnets. Before that, I had formulated a theory which explained the kind of magnetism we have in the garnets, and certainly that set the stage for understanding these materials. There was even a magnetic material that was discovered as a consequence of my theory . . . . My work has almost always been to propose the theoretical background for work others do in developing technology."

Anderson will be the fifth Bell Labs scientist to be awarded the Nobel Prize in Physics. In 1937, Clinton C. Davisson shared the award for discovery of the wave nature of matter, which was vital to the subsequent development of modern physics and its impact on technology from atomic energy to the transistor. The Nobel Prize for the transistor was awarded in 1956 to John Bardeen, William H. Brattain, and William B. Shockley.