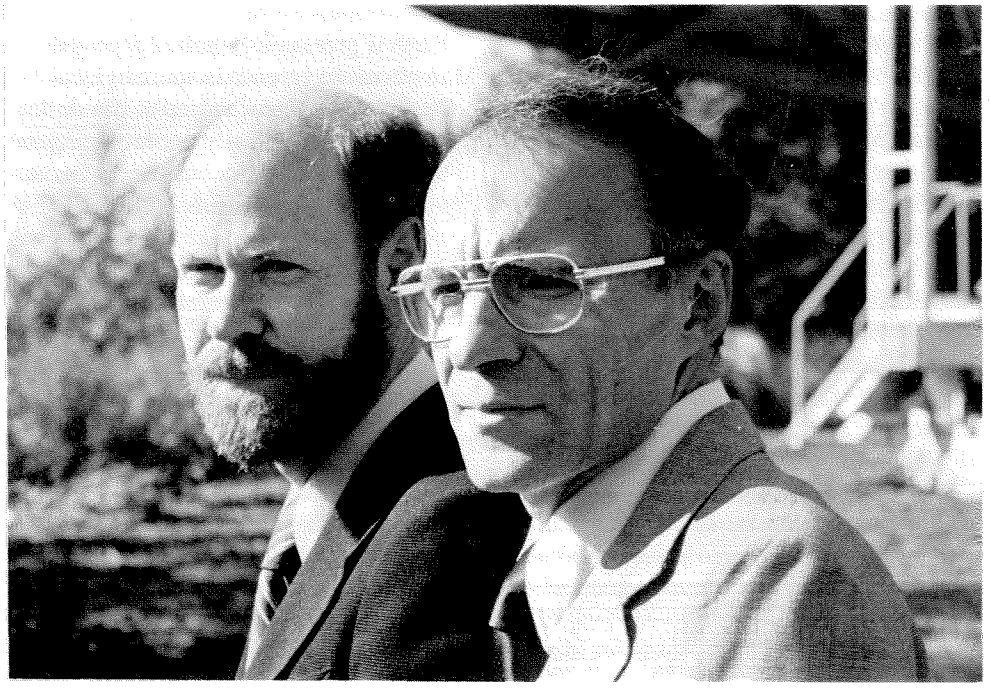

Caltech alumnus Robert W. Wilson and his colleague Arno A. Penzias shared half of the 1978 Nobel Prize in physics for their discovery of cosmic background radiation.

Robert Wilson

Nobel Laureate

For the last 18 billion years — give or take a few billion — our universe has been flying apart as the result of the cataclysmic explosion astronomers call the "big bang." In the course of expansion and cooling over the aeons since, the flash of radiation from that explosion has become more and more dilute. It now permeates the whole universe and has a temperature of approximately 3 degrees K. Discovering that radiation and recognizing its source earned the 1978 Nobel Prize in physics for Arno A. Penzias and Caltech alumnus Robert W. Wilson. This is the 18th Nobel Prize awarded to a Caltech faculty member or alumnus, and the first in an area of astronomy.

Penzias and Wilson made their discovery while working at Bell Telephone Laboratories. In 1963 and 1964 they were using for radio astronomical observations a 20-foot horn antenna located in Holmdel, New Jersey. The antenna had been built for receiving Telstar satellite signals with a minimum of noise interference. The less noise, the clearer the satellite voice and pictures would be. This receiving system, which used a maser cooled by liquid helium as an amplifier, had very low noise. But regardless of the direction in which they pointed the antenna, they received a low, steady hissing. Was this noise really from the sky, or was it generated in their receiver? Penzias and Wilson decided to make an all-out search for the source and, if it was in the antenna, to try to eliminate it.

First they measured the noisiness of the maser very precisely, using as a calibration standard a resistor immersed in liquid helium. They also evicted a pair of pigeons that had built a nest in the horn. Wilson climbed inside the

horn and masked all the rivets and joints with metallic tape. All this effort reduced the noise only slightly — perhaps half a degree — and they were forced to conclude that though the hiss was real they couldn't explain it. It was, said Penzias later, like "cigar smoke in a room where there is no cigar."

At this point, chance stepped in. In the course of a casual conversation Penzias learned of the existence of an unpublished paper reporting on some research at Princeton. A group at that university, trying to detect evidence of the big bang, had determined that such an explosion ought to have left a detectable remnant in the form of microwave radiation (which it is convenient to characterize by its temperature) that would uniformly permeate space. Further, some 18 billion years afterwards, the radiation temperature should be about 3.5 degrees Kelvin. With this theoretical explanation, Wilson and Penzias at last realized that the noise they were hearing was the residual evidence of the primordial fireball — an echo of creation.

Penzias and Wilson announced their discovery in a letter to the *Astrophysical Journal* in the spring of 1965, in which they described their measurement of excess antenna temperature. In the same issue, the Princeton group — Robert Dicke, P. G. Roll, David Wilkinson, and James Peebles — provided the cosmological explanation for the excess. (It also turned out that in the late 1940's George Gamow and his co-workers Alpher and Hermann had predicted radio noise as a result of the big bang.) Describing the importance of the discovery 13 years later, the Royal Swedish Academy of Sciences said, "This has made it possible to obtain information about cosmic processes that took place a very long time ago, at the time of the creation of the universe. The work has opened up a whole new horizon in cosmology. It gives us an absolute system of measuring movements of the earth and other heavenly bodies."

Subsequent studies of the microwave background radiation have shown that it fits very well the theoretical spectrum of a black body at a temperature of about 2.9 K. The radiation is very uniform; that is, small-scale variations in the temperature are less than a few milliKelvin, while a small difference (of $\pm$ 0.0035 K) in temperature in opposite directions in the sky is interpreted as evidence that the Sun is moving at a velocity of about 390 km/sec with respect to the radiation field.

Alumnus Robert Wilson lives in Holmdel with his wife, two sons, and a daughter. A native of Houston, Texas, he is at 42 the youngest of this year's Nobel Prize winners. He graduated from Rice University in 1957 with honors in physics and received his PhD from Caltech in 1962 for research in radio astronomy. After spending a postdoctoral year at the Owens Valley Radio Observatory, he went to Bell Labs in 1963. He is now head of Bell's Radio Physics Research Department, and he also does research in radio astronomy, being particularly interested in investigation of dark clouds in the galaxy through measurements on molecules. He is a member of a number of professional astrophysical societies.

Outside astrophysics, the only hobbies Wilson claims are "pecking at the piano" and ice skating. That's probably plenty for a man who says, "Science is my life, and I'm very deeply involved in my work. Otherwise, I'm a rather quiet fellow." Quiet enough, as a matter of fact, to have heard an 18-billion-year-old echo. □

The Nobel Prize ceremonies in Stockholm last December gave Penzias and Wilson a special occasion to wear white ties, tailcoats, and broad smiles — and to congratulate each other on the rewarding outcome of their collaboration.