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Class 6

1/14/13

Extra Credit Essay

Robert C. Richardson

Robert C. Richardson was born on the twenty-sixth of June, 1937 in Washington D.C. He was raised in Arlington, Virginia with his with his mom and dad, Lois and Robert Richardson, and his younger sister, Addie. During World War II, he only lived with his mother and Addie, as his father joined the U.S. Army to fight in the war effort. In his youth, he was a very active Boy Scout, even becoming an Eagle Scout in the least amount of time possible according to the rules. He enjoyed the outdoor activities, such as hiking, camping, bird watching, etc.

He does not remember having any special interest in science as a child, but Richardson admits that he loved school very much. When he was in third grade, he switched schools after he moved out of the apartment his family had during the war, and as a result, began to attend Walter Reed Elementary School in another part of Arlington. Although it was overcrowded, he still tried his hardest to pay as much attention as he could manage. During summer break, he attended summer school simply to have something to do. The summer school teacher was confused why he was there with such high grades, and had him skip a grade.

When Richardson reached his high school years, he worked at a Boy Scouts camp called Camp Letts during his summers. He graduated from Washington-Lee High School in 1953 with a class of about 925 people. He was in a six way tie for nineteenth place out of his classmates

academically. There was not anything special about the math or science classes Washington-Lee offered. Richardson was not in any sort of advanced placement classes, as they were not invented yet.

In the fall of 1954, he attended Virginia Polytechnic Institute, also known as Virginia Tech. He started out by taking electrical engineering classes, but quickly grew bored with the material. His next major was chemistry, but struggled in quantitative analysis due to his colorblindness. When he voiced this problem to his professor, he told him that he was not suited to be a chemist. He then turned to physics. Although he was not a diligent student, he still was able to receive to decent education in physics. He graduated with a B average. He remained at Virginia Tech until he received his Master's Degree, and joined the army as an Army officer, intending to attend a Master's in Business Administration program afterwards. Richardson ended up not enjoying the business program, and returned to graduate school to get his Ph.D. in physics.

Horst Meyer asked Richardson if he would work for him at Duke University. Richardson then entered Duke as a full-time graduate student in 1960. Later, in 1965, he developed a thesis about the exchange interaction in solid Helium-3. He stayed at Duke for one more year as a research advocate until Cornell University decided to expand and start researching low temperature physics. The Laboratory of Atomic and Solid State Physics invited him to work on research on low temperature Helium with David Lee and John Reppy. Richardson stayed at Cornell University for about thirty years. During his time there, experimented with mainly helium-3 and learned how to teach undergraduate physics courses, something he wanted to learn how to do for a while.

In 1996, Robert Richardson, along with his colleagues at Cornell, David Lee and Douglas Osheroff, were awarded the Novel Prize in Physics for their discovery of superfluity in Helium-3. This means that the isotope has the ability to flow without resistance. Their study began in the 1970's. The anisotropic superfluid helium-3 appears below two thousandths of a degree above absolute zero. Their discovery has led to concepts that could be useful, such as it could help the theoretical treatment of high temperature superconductors. The critical points of the superfluid helium-3 are used to help define temperature scales with values very close to absolute zero.

The superfluity of helium-3 first showed as small differences in the melting curve of solid helium-3. At first, it was thought it was thought to simply be mechanical errors by their equipment, but Richardson, Lee, and Osheroff began to think otherwise after it kept reoccurring in the data. During the experiments, they were not looking for superfluity, but rather for an antiferromagnetic phase in solid helium-3. In the group's first publication, in 1972, they misinterpreted the information as the antiferromagnetic phase. After perfecting their technique and making new measurements, they were able to find the cause of what was causing the anomalies. It turned out to be two phase transition in the liquid phase.

Richardson, Lee and Osheroff ran into some problems with their thermometer during one of their first experiments at below a few thousandths of a degree from absolute zero. They then monitored the pressure in their sample of helium-3 under external pressure that increases over time. Osheroff was the one who first observed how the pressure in the sample varied as time went on. He noticed two anomalies, one of which later turned out to be the transition to phase A where the individual members of the boson pairs have parallel spins. The second of the

anomalies was phase B, where the members of the boson pairs have both anti-parallel and parallel spins.

Richardson and Osheroff both found characteristic changes of the resonance frequency during the phase transition. The transitions are changes that are dependent on the temperature and magnetic field strength. The changes are different in phase A and phase B. The physicists were not able to explain the characteristic behavior, in detail, but theoretician Leggett was able to in only a few weeks. Each pair of the nuclear spins are paired with the rotation, and showed the importance of the phase of the macroscopic wave function that helps describe the condensate. Two groups after Richardson, Osheroff, and Lee were able to confirm and once again prove that the new phases of helium-3 were in fact superfluid.

Sources:

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