

William Walters

Mr. Smith

IB Physics

2 April 2015

### **Extra Credit Essay - Lev Davidovich Landau**

Lev Landau was born on January 22, 1908 to Jewish parents Lyubov Veniaminovna Harkavi and David Lvovich Landau in Baku, Azerbaijan. Lyubov was trained in medicine and had done work in physiology, and worked in this field until her children were born, when she then focused in on being a midwife and doctor. David was a petroleum engineer with the Black Sea and Caspian Sea Stock Company, often working in the oil fields of Baku on the coast of the Caspian sea, but was also highly proficient in mathematics, to which he taught to Lev (The MacTutor History of Mathematics Archive). Being born into a family with two successful and intelligent parents gave Lev a solid foundation in which education was highly emphasized. When Lev was eight years old, he began attending a Jewish high school that opened in Baku, and learned French and German while being a brilliant student in science and mathematics. Even though Calculus was not a required part of his schooling, he became proficient in it on his own, and says he could not remember a time in his life when he was not proficient at differentiation and integration (The MacTutor History of Mathematics Archive). At 13, he finished his secondary schooling requirements, but his parents still thought him too young to enter college. He ended up going to an economic and technical school for a year before he entered a university, which would start his career.

At the age of 14, Lev Landau entered Baku State University where he studied in both the Physics and Mathematics Department and the Chemistry Department (The MacTutor History of Mathematics Archive). While he enjoyed Chemistry, and it remained a life long interest, in 1924 he shifted his focus solely to physics, and moved to Leningrad State University. After graduating from there in 1927, he received a doctorate from the Leningrad Physico-Technical Institute at age 21. After this, he traveled around Europe to study abroad, but perhaps the most influential place he studied was at the Niels Bohr Institute for Theoretical Physics in Copenhagen. From then on, he considered himself a Pupil of Niels Bohr, and his approach to Theoretical Physics was greatly influenced by him. In 1937, he married a girl from Kharkov by the name Kora T. Drobanzeva, and had a son Igor in 1946. On January 7, 1962, the same year he won the Nobel Prize for Physics, his car collided with an oncoming truck while driving from Moscow to Dubna. Others in the car only suffered minor cuts and bruises, but he suffered serious fractures and injuries to his internal organs. He was taken to a hospital in Moscow, and stayed in a coma for two months, and although he recovered in many ways, he never was well enough again to return to his work in physics full time, as he suffered in pain for the last six years of his life. He was also not able to accept his Nobel Prize in person, the Swedish ambassador to the Soviet Union gave the prize to him. He died on April 1, 1968, due to complications from the accident (The MacTutor History of Mathematics Archive).

While Lev Landau is also known for numerous contributions to theoretical physics, he was awarded the Nobel Prize in Physics in 1962 specifically for his work with low temperature physics (Your Dictionary). His work in this area began in 1937 when he arrived at the Institute of Physical Problems of the Soviet Academy of Sciences to be in charge of its

theoretical section. One way he did his research was by cooling helium down to almost absolute zero so that the mass could be measured. From this, he came up with his theory of helium II being a “quantum liquid,” meaning its properties and characteristics could not be considered in the same framework of those of classical mechanics. He postulated that helium II had not one but two different types of motion: normal, which is viscous and a conductor of heat, and superfluid, which is neither viscous, nor does it transport heat. From this, he predicted not only that a superfluid countercurrent whose behavior obeys the hydrodynamic laws that cover ideal and non-viscous fluids with irrotational flow, but also that the two velocities of sound waves occur if sound is put through the helium II (Your Dictionary). Specifically for this work and his theories, he was awarded the Nobel Prize in Physics in 1962.

From the beginning, Lev Landau had many political and social factors influencing him. Born in Azerbaijan, he had many influences due to its location and culture. He was Jewish, and his mother was from the Soviet Union. He later went to university there, and ended up going around Europe for work, and as a result would learn many languages in his lifetime (The MacTutor History of Mathematics Archive). The period of the Soviet Union to become a dominant world power, meaning there was a strong emphasis on the sciences and mathematics, took place during Landau’s career. This geopolitical factor influenced his work (Encyclopedia.com).

In fact, Landau had to deal personally with the Soviet Union during his career. He became increasingly unhappy with how Josef Stalin was leading the country. Soon after, he started the Great Purge to systematically eliminate his opposition in order to gain complete control of the country. During this time, the KGB began investigating Landau after they were informed that

he was making anti-government statements. He was arrested on April 27, 1938 and taken to Lubyanka prison (The MacTutor History of Mathematics Archive). He was held there until the head of the Institute of Physical Problems, Pyotr Kapitsa, an experimental low-temperature physicist, wrote directly to Josef Stalin personally defending Landau, and threatening to quit the institute if he was not let go. He was released soon after, and then went on to explain one of Kapitsa's superfluidity theories (Wikipedia). Although Landau believed strongly in Communist principles, he came to strongly dislike Josef Stalin and the Soviet leadership during his career.

While Landau won the Nobel Prize for his work in low-temperature physics, he also made numerous other contributions to science. When he became a full professor and Moscow State University, he won the Stalin Prize for his thermodynamic theory of phase transitions in solid bodies and symmetry properties, as well as published a paper on the vibrations of electric plasma. With these contributions and others, it is generally accepted that his work was a huge contributor to the development of the Soviet Union atomic bomb. During his career, Landau also published over 120 papers in the areas of hydrodynamics, aerodynamics, thermodynamics, astrophysics and quantum field theory, to name a few. For all this, he received international acclaim from countries and academies in the United States, England and Germany (Your Dictionary).

## Citations

"Lev Davidovich Landau." *The MacTutor History of Mathematics Archive*. School of Mathematics and Statistics University of St Andrews, Scotland, 1 Jan. 2014. Web.

<[http://www-history.mcs.st-and.ac.uk/Biographies/Landau\\_Lev.html](http://www-history.mcs.st-and.ac.uk/Biographies/Landau_Lev.html)>.

"Lev Davidovich Landau Facts." *Your Dictionary*. LoveToKnow, Corp. Web.

<<http://biography.yourdictionary.com/lev-davidovich-landau>>.

"Lev Davidovich Landau." *Encyclopedia.com*. HighBeam Research Inc., 2008. Web.

<[http://www.encyclopedia.com/topic/Lev\\_Davidovich\\_Landau.aspx](http://www.encyclopedia.com/topic/Lev_Davidovich_Landau.aspx)>.

"Lev Landau." *Wikipedia*. Wikimedia Foundation Inc. Web.

<[http://en.wikipedia.org/wiki/Lev\\_Landau](http://en.wikipedia.org/wiki/Lev_Landau)>.