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Physics Research Paper

The Discovery of Radioactivity/Discovery of Polonium and Radium

Nobel Prize in Physics ~ 1903

Just three years after the turn of the century, science, primarily physics, was expanding the knowledge of the natural world in leaps and bounds. Many new periodic elements were being rapidly discovered. New scientific processes were being instituted and perfected. New technologies enabled scientists to better explore the vast, unknown scientific world. Arguably the most important discovery that modern science had ever seen at the time was presented to the Nobel Science Commission in 1903, jointly, by Antoine Henri Becquerel, Marie Curie, and Pierre Curie. All three of these famous physicists were awarded the Nobel Prize in Physics in 1903, representing France, for their discovery and study of radioactivity. According to the Nobel Prize awarding commission, A. Henri Becquerel was awarded half of this prestigious prize "in recognition of the extraordinary services he has rendered by his discovery of spontaneous radioactivity," and the husband and wife team of Marie and Pierre Curie were jointly awarded the remaining half of the prize "in recognition of the extraordinary services they have rendered by their joint researches on the radiation phenomena discovered by Professor Henri Becquerel." (1)

Radioactivity is defined as the "Spontaneous emission of radiation, either directly from unstable atomic nuclei or as a consequence of a nuclear reaction.

The radiation, including alpha particles, nucleons, electrons, and gamma rays, [are] emitted by a radioactive substance.”⁽²⁾ Based on the previous studies of Wilhelm K. Röntgen, who discovered rays of radiation emanating from several elements, and Hendrik A. Lorentz and Pieter Zeeman, who tested the influence of magnetism on radiation, A. Henri Becquerel performed several experiments on the fascinating study of radiation. While studying radiation, Becquerel observed, after many hours of intense study, that gases became electrically conductive after “uranium rays” were passed through them, however he never officially named this phenomenon “radioactivity,” and his research was largely dismissed by his peers.⁽³⁾ In a failed experiment (which incidentally won him a Nobel Prize), Becquerel attempted to expose phosphorescent uranium salts to bright sunlight and record the effect this uranium ore had on photographic plates. He believed the sunlight had an important part in explaining the luminescence of uranium ore. After several days of sunless weather, Becquerel was astonished to find that another new type of radiation “spontaneously” emanated from the uranium ore which was able to pass through metal foil and expose the photographic plates without the presence of sunlight at all!⁽⁴⁾

The Marie and Pierre Curie team, interested by Becquerel’s discovery, decided to investigate these mysterious “uranium rays” and continued Becquerel’s ingenious study. In her doctoral thesis presented before *l’Académie des Sciences*, the French Academy of Science, Marie Curie proposed the idea that the “ability to radiate did not depend on the arrangement of the atoms in a molecule, it must be linked to the interior of the atom itself.”⁽⁵⁾ The Curies decided to separate the Uranium ore and probe its composition for new

elements. She and Pierre obtained large amounts of uranium ore, and proceeded to perform the daunting task of separating small amounts of independent composites from this ore, which she proposed were even more active than the original element. Through their intense research, the Curies discovered two new highly radioactive elements: polonium and radium.⁽⁶⁾

The work of Becquerel and the Curies resulted in many other famous discoveries not only in physics, but in the entire field of scientific research. Some of the scientists who made future discoveries as a result of the previous findings of Becquerel and the Curies were also awarded Nobel Prizes⁽⁷⁾, such as Ernest Rutherford, who won the 1908 Nobel Prize in Chemistry "for his investigations into the disintegration of the elements, and the chemistry of radioactive substances,"⁽⁸⁾ and Joseph John Thomson, who won the 1906 Nobel Prize in Physics "in recognition of the great merits of his theoretical and experimental investigations on the conduction of electricity by gases."⁽⁹⁾ Their discoveries also had a profound impact in the medical field: their research has created the foundation for modern cancer radiation procedures and also discovered the beneficial uses of X-rays.⁽¹⁰⁾

Works Cited

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