A Student's Guide to Nuclear Physics

By Andrew Nassif

(Article based on research in the field as well as new revolutionary ideas described in layman terms.)

What is Nuclear Physics?

Nuclear Physics is a major subject in Physics as well as a sub subject in chemistry that deals with the study of radioactive elements and materials as well as how they work and can be used. Its main field of study is interactions that happen in the nuclei of a compound or of an element. Nuclear Physics is also a major field of particle physics as well. Nuclear Physics also includes using radioactive elements in fields such as medicine and technology. It also can focus on emission processes such as Neutron Emission, Positron Emission, and Proton Emission. Henri Becquerel discovered radioactivity in 1896, and is thought to be the father of nuclear physics. Henri's experiment was the investigation of phosphorescence in uranium salts. A year later J.J. Thomson made the discovery of the electron which was the second most major discoveries in nuclear physics since Henri's discovery. Thomson and Henri's discoveries led to more major scientific discoveries in there time including the discovery of alpha, beta, and gamma ray radiation. Nuclear Physics is also known as the study of high energy processes and nucleosynthesis that takes place between elements. The two must major fundamentals of Nucleosynthesis are Stellar and Supernova Nucleosynthesis.

Rutherford's Discovery of the Nuclei

In 1907, a young scientist name Ernest Rutherford published his paper on "Radiation of the Alpha Particle from Radium in passing through Matter." Hans Geiger worked with the Royal Academy and Rutherford to expand the idea thoroughly. They made a model of the alpha particle passing through aluminum and a gold leaf, later did they know, they discovered the nucleus. In 1912 Rutherford explained the idea of a nucleus existing in the atom as well as the theory behind it. His work was accepted as the Plum-Pudding model, and his idea was published into one of the most major scientific journal of his time receiving much media coverage. However, there were some skeptics of the idea.

Studies of a Nuclear Spin

In 1924 Dr.Wolfgang Pauli shared his idea of a two valued Quantum degree of freedom. In 1929 Franco Rasetti carried out the idea and classified it as a, "Nuclear Spin". The bottom image is an equation used to find the spin multiplicity as well as angle of protectory.

$$S_i = \hbar s_i, \quad s_i \in \{-s, -(s-1), \ldots, s-1, s\}$$

Now we look at the Quantum spin projecting towards a z-axis without having an independent quality or quantity. $S_z = \hbar s_z, \quad s_z \in \{-s, -(s-1), \ldots, s-1, s\}$

Next we theoretically look at a spin vector: $\langle S \rangle = [\langle S_x \rangle, \langle S_y \rangle, \langle S_z \rangle]$

James Chadwick Discovers the Neutron

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James Chadwick recognized a neutral particle about the same size of a proton and causing radiation in Becker's experiment. In 1932, he published his research and became recognized as having discovered one of the most major discoveries of his time.

What is Binding Energy?

Binding energy is known as mechanical energy that is required to disassemble a whole into separate part. Binding energy is also a representation of mechanical work that works against forces together. In low binding energies, the lost mass that is remaining after binding is fractionally very small.

Classification of Rare Einsteinium

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ES
Element Number/Atomic Number=99
Atomic Mass= 252

Found in Synthetic Elements
It is the 17th transuranic element
It is an actinide
Found in period 7 of the periodic table

Configuration: 1s2 2s2p6 3s2p6d10 4s2p6d10f14 5s2p6d10f11 6s2p6 7s2
Valence Electrons: 5f11 7s2

Color: Silver-colored
Texture: It Is a para-magnetic structure that is found in crystal form or powdered form and turned into rod form in nucleic transistor reaction chambers
Electrical Conduction: It has an Electronegativity of 1.3
Density near r.t.: 8.84 g·cm·3
Crystal Structure: Face-Centered Cubic
Ionization Energies: 1st: 619 kJ·(mol^·1)
Hazards: Extremely Radioactive
Possible Isotopes: Hypothesized as possibly the Isotope of Plutonium and Uranium-328, but it is to dangerous to test
Ionic Radii: 0.925Å
Heat of Fusion: kJ/mol
Melting Point: 1133 K,·860 °C,·1580 °F

Possibility of Nuclear Fusion: Very high rate of possibility
Filling Orbital: 5f11
First Ionization Potential: 6.42
Chemical Manipulation: Glows at~300 μg of 253Es
Thermal Conductivity: 0.1 W/cmK
Exposure to light: requires Indirect exposure when not an isotope
Oxidation States: 3

By G.R. Choppin, S.G. Thompson, A. Ghiorso and G.G. Harvey in 1952, in the Berkeley

How: Using Nuclear reactors to split metallic alloys from Uranium, (which is extremely dangerous if you don't know what your doing)

Cas# 7429-92-7

It is one of the rarest metals on earth, if not the rarest, the most that exists out of it is 225g

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1 As in nuclear radiation chemistry

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2 The third quantity is measured in the z coordinate

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3 This discovery is recognized as the 7th most major discovery in the field of Physics, the 12th most major discovery in the field of science.

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4 Einsteinium is one of the rarest elements on Earth, out of all the radioactive element it is considered the rarest.

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