Rest Energy Encyclopedia Article

Rest Energy

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Contents

Rest Energy Encyclopedia Article.....1

Contents.....2

Rest Energy.....3

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The rest **energy** of an object is the amount of energy that would be released were all of its **mass** converted directly into energy according to Albert Einstein's famous equation: $E=mc^2$, where c is the speed of **light** in a **vacuum**, measured to be 186,000 mi/s (300,000 km/s). This relationship states that mass is just another manifestation of energy, and converting mass into energy and vice-versa is possible.

Early in the twentieth century **nuclear fission** reactions demostrated the truth behind Einstein's $E=mc^2$ and his theory of special relativity of 1905. A nuclear fission reaction is when the **nucleus** of a large **atom**, called the parent nucleus, splits to form many smaller nuclei, called daughter products, that then spread apart. However, the mass of the smaller nuclei does not add up to the mass of the parent. In fact, the total mass of the daughter products is less than the mass of the parent nucleus in the fission nuclear reaction. Einstein's theory explains where the absent mass went. The mass was converted into the **kinetic energy** the daughter products used to spread apart.

The kinetic energy released in the nuclear fission processes is used to produce **heat** and steam to turn electrical **generators** in nuclear **power** plants. In **nuclear fusion** processes, two small nuclei are combined to form a single larger nucleus and other byproducts. In nuclear fusion reactions, mass is also converted into the kinetic energy of the byproducts. In some **nuclear reactions**, the energy released can be violent and tremendous, as is the case for atomic and hydrogen bombs.