

# The Basics Of Nuclear Physics

## Core Concepts

Radioactive waste is broadly classified into 3 categories: low-level waste (LLW), such as paper, rags, tools, clothing, which contain small amounts of mostly short-lived radioactivity; intermediate-level waste (ILW), which contains higher amounts of radioactivity and requires some shielding; and high-level waste (HLW), which is highly radioactive and hot due to decay heat, thus requiring cooling... In general terms, the hybrid is very similar in concept to the fast breeder reactor, which uses a compact... Nuclear weapons have had yields between 10 tons (the W54) and 50 megatons for the Tsar Bomba (see TNT equivalent). Yields in the low kilotons can devastate cities. A thermonuclear weapon weighing as little as 600 pounds (270 kg) can release energy equal to more than 1.2 megatons of TNT (5.0 PJ). Apart from the blast, effects of nuclear weapons include extreme heat and ionizing radiation, firestorms, radioactive nuclear fallout, an electromagnetic...

**Nuclear physics** Nuclear physics is the field of physics that studies atomic nuclei and their constituents and interactions, in addition to the study of other forms of Nuclear physics is the field of physics that studies atomic nuclei and their constituents and interactions, in addition to the study of other forms of nuclear matter

The basic idea is to use high-energy fast neutrons from a fusion reactor to trigger fission in non-fissile fuels like U-238 or Th-232. Each neutron can trigger several fission events, multiplying the energy released by each fusion reaction hundreds of times. As the fission fuel is not fissile, there is no self-sustaining chain reaction from fission. This would not only make fusion designs more economical in power terms, but also be able to burn fuels that were not suitable for use in conventional fission plants, even their nuclear waste. Discoveries in nuclear physics have led to applications in many fields such as nuclear power, nuclear weapons, nuclear medicine and magnetic resonance imaging, industrial and agricultural isotopes, ion implantation in materials engineering, and radiocarbon dating in geology and archaeology. Such applications are studied in the field of nuclear engineering. The SI base unit of mass is the kilogram (kg). In physics, mass is not the same as weight, even though mass is...

**Radioactive waste** The storage and disposal of radioactive waste is regulated. Radioactive waste is a type of hazardous waste that contains radioactive material. The storage and disposal of radioactive waste is regulated by government agencies in order to protect human health and the environment. nuclear power generation, nuclear decommissioning, rare-earth mining, and nuclear weapons reprocessing. It is a result of many activities, including nuclear medicine, nuclear research, nuclear power generation, nuclear decommissioning, rare-earth mining, and nuclear weapons reprocessing.

**Mass** Mass can be experimentally defined as a measure of the body's inertia, meaning the resistance to acceleration (change of velocity) when a net force is applied. Nuclear Physics B: Proceedings Supplements. arXiv:physics/0111134. Mass in modern physics has multiple definitions which are conceptually distinct, but physically equivalent. The object's mass also determines the strength of its gravitational attraction to other bodies. It was found that different atoms and different elementary particles, theoretically with the same amount of matter, have nonetheless different masses. 110 Mass is an intrinsic property of a body. It was traditionally believed to be related to the quantity of matter in a body, until the discovery of the atom and particle physics. "Photons, Clocks, Gravity and the Concept of Mass";. 110: 151-155. Bibcode:2002NuPhS

Particle physics evolved out of nuclear physics and the two fields are typically taught in close association. Nuclear astrophysics, the application of nuclear... Typically, short pulse lasers deposit energy on a hohlraum. Its inner surface vaporizes, releasing X-rays. These converge on the pellet's exterior, turning it into a plasma. This produces a reaction force in the form of shock waves that travel through the target. The waves compress and heat it. Sufficiently powerful shock waves achieve the Lawson criterion for fusion of the fuel.

**Nuclear fusion-fission hybrid** their nuclear waste. In general terms, the hybrid is very similar in concept to the fast breeder reactor, which uses a compact high-energy fission core in Hybrid nuclear fusion-fission (hybrid nuclear power) is a proposed means of generating power by use of a combination of nuclear fusion and fission processes.

**Organic nuclear reactor** An organic nuclear reactor, or organic cooled reactor (OCR), is a type of nuclear reactor that uses some form of organic fluid, typically a hydrocarbon. An organic nuclear reactor, or organic cooled reactor (OCR), is a type of nuclear reactor that uses some form of organic fluid, typically a hydrocarbon substance like

polychlorinated biphenyl (PCB), for cooling and sometimes as a neutron moderator as well

Nuclear physics should not be confused with atomic physics, which studies the atom as a whole, including its electrons. Using an organic fluid had a major advantage over conventional designs using water as the coolant. Water tends to corrode and dissolve metals, both the nuclear fuel and the reactor as a whole. To avoid corrosion of the fuel, it is formed into cylindrical pellets and then inserted in zirconium tubes or other "cladding" materials. The rest of the reactor has to be built out of materials that are both corrosion resistant and resistant to the effects of neutron embrittlement. In contrast, many common organic fluids are less corrosive to metals... ICF is one of two major branches of fusion research; the other is magnetic confinement fusion (MCF). When first proposed in the early 1970s, ICF appeared to be a practical approach...

Nuclear weapon pp. 67. Both bomb types release large quantities of energy from relatively small amounts of matter. "Command and Control: Nuclear Weapons, the Damascus Accident, and the Illusion of Safety"; Bibcode:2014PhT A nuclear weapon is an explosive device that derives its destructive force from nuclear reactions, either nuclear fission (fission or atomic bomb) or a combination of fission and nuclear fusion reactions (thermonuclear weapon), producing a nuclear explosion. Physics Today. Vol. Eric (2013). 48-50

Atoms are extremely small, typically around 100 picometers across. A human hair is about a million carbon atoms wide. Atoms are smaller than the shortest wavelength of visible light, which means humans cannot see atoms with conventional microscopes...

Nuclear fuel Some concern has been expressed that used MOX cores will introduce Nuclear fuel refers to any substance, typically fissile material, which is used by nuclear power stations or other nuclear devices to generate energy. (LEU) fuel used in the light water reactors which predominate nuclear power generation

Atom Archived from the original on 5 December 2006. Laboratory. An atom consists of a nucleus of protons and generally neutrons, surrounded by an electromagnetically bound swarm of electrons. Atoms with the same number of protons but a different number of neutrons are called isotopes of the same element. For example, any atom that contains 11 protons is sodium, and any atom that contains 29 protons is copper. "Basics of Nuclear Physics and Fission"; The

chemical elements are distinguished from each other by the number of protons that are in their atoms. Atoms are the basic particles of the chemical elements and the fundamental building blocks of matter. Makhijani, Arjun; Saleska, Scott (2 March 2001) 8f3e92ce6c

Inertial confinement fusion included three primary concepts; energy generation under Project PACER, the use of nuclear explosions for excavation, and for fracking in the natural gas industry Inertial confinement fusion (ICF) is a fusion energy process that initiates nuclear fusion reactions by compressing and heating targets filled with fuel. The targets are small pellets, typically containing deuterium ( $2\text{H}$ ) and tritium ( $3\text{H}$ ) 8f3e92ce6c

Nuclear magnetic resonance High-resolution nuclear. dynamic nuclear polarization, by the work of Anatole Abragam and Albert Overhauser, and to condensed matter physics, where it produced one of the first Nuclear magnetic resonance (NMR) is a physical phenomenon in which nuclei in a strong constant magnetic field are disturbed by a weak oscillating magnetic field (in the near field) and respond by producing an electromagnetic signal with a frequency characteristic of the magnetic field at the nucleus. 20 tesla, the frequency is similar to VHF and UHF television broadcasts (60–1000 MHz). NMR results from specific magnetic properties of certain atomic nuclei. This process occurs near resonance, when the oscillation frequency matches the intrinsic frequency of the nuclei, which depends on the strength of the static magnetic field, the chemical environment, and the magnetic properties of the isotope involved; in practical applications with static magnetic fields up to ca 8f3e92ce6c

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