

Physicists Ponder Basic Meaning Of Newly Discovered Nuclear Principles

PARTICLES			ANTIPARTICLES		
ELECTRIC CHARGE			ELECTRIC CHARGE		
NEGATIVE	NEUTRAL	POSITIVE	NEGATIVE	NEUTRAL	POSITIVE
2583 XI	2580 XI				XI
2247 SIGMA	2323 SIGMA	2227 SIGMA			SIGMA
	2182 LAMBDA				LAMBDA
	1838.62 NEUTRON	1836.08 PHOTON			ANTINEUTRON
	964.80 K	964.76 K			K
273.26 PI		264.27 PI			PI
206.85 MU					MU
ELECTRON					POSITRON
	NEUTRINO				ANTINEUTRINO
		PHOTON			

NUCLEAR ZOO: The 30 known particles that make up the nucleus of an atom are shown on this chart prepared by the Argonne National Laboratory. Each of 14 particles has its opposite number in anti-particles. There is also a photon and a pi meson (shown on curved bands) which are their own anti-particles. An anti-particle carries an opposite electrical charge from a particle.

Editor's Note: Scientists slowly are forcing the atom to yield its secrets. But each new secret revealed presents a new puzzle — like the strange "nuclear zoo" which doesn't seem to make sense at all.

By **ALTON BLAKESLEE**
AP Science Writer

By shaking and beating the hearts of atoms, physicists are inducing them to yield their secrets.

But atoms have replied to this assault with a confusing array of partial confessions.

Battering the nucleus has produced a zoo of 30 known or predicted particles, "all with an insulting lack of obvious meaning," as Dr. Robert Oppenheimer, famed nuclear physicist, puts it.

Physicists are desperately hunting for a code, a theory or a new principle, to make sense of them all.

They don't yet know whether the 30 particles are all elementary bits of matter — most experts doubt they are — or different combinations of a smaller number of them.

But they have refined their concept of what an atomic nucleus is like.

One great step came before the war, when Japan's Dr. Hideki Yukawa proposed a solution to a fundamental puzzle.

This mystery was why an

new force, one of attraction, into the nucleus to offset the repulsion force between protons.

Little Solar Systems

A proton, physicists now think, is also a kind of miniature solar system. That is, one or more mesons form a fast-moving cloud around it, much like an electron whirls around the whole atomic nucleus.

This is a wheel within a wheel.

The same thing applies to neutrons. And there are even some suspicions now that the pi meson itself may consist of smaller particles wheeling around one another.

The nucleus now is conceived of consisting of protons and neutrons — exchanging mesons — plus the photon, the basic unit of light waves.

The rest of the zoo of particles is produced when nuclei are smashed by firing high-speed bullets of protons or electrons into them.

Out come such strangely-named particles as the muon and K meson. And far more massive particles given Greek designations such as xi, sigma, and lambda particles. Some are called "strange" particles because they had unexpected properties.

In nature's symmetry, every particle has an anti-particle. The anti is exactly the same thing, except it has an opposite electric charge or reversal of magnetic behavior.

Known now are 14 particles, plus their 14 anti-particles. There are also the photon and the neutral pi meson, each of which is its own anti-particle.

All the 30 particles have actually been detected except for a few of the anti-particles.

What happens when a particle and its anti-particle meet? Annihilation, with a tremendous burst of energy. This energy in many cases ultimately turns into light waves.

Anti-particles come flying out when an atomic nucleus is hit hard enough.

Anti-Matter Stars

Somewhere, perhaps, there are galaxies or Milky Ways of stars and planets composed of this anti-matter, scientists speculate. Atoms there would be composed of anti-protons and anti-neutrons, with anti-electrons (positrons) whirling about them.

Anti-particles, such as the anti-proton, were detected by the annihilating collisions and tracks they left when they hit atoms in special photographic plates.

Scientists have developed ingenious methods of being able to "see," track, identify and characterize the totally invisible pieces or particles flying out from smashed atoms.

They can detect particles for several reasons.

One is that most have electric charges. Most are spinning, like tops, and act like tiny magnets. They differ in their masses or weights. They differ in their brief lifetimes.

Charged particles zipping out from an atom can be directed, steered or bent in their paths by using electromagnetic forces.

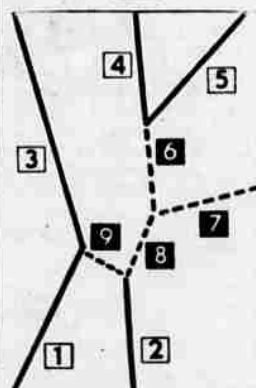
Thus they can be channeled to strike photographic film, or to pass through cloud chambers or bubble chambers, or through electronic counters.

Each kind of particle leaves special tracks on photographic film.

New particles are recognized through unusual tracks. Often, theorists predict what type of track a particle will leave, even before it has even been detected.

Hours of work with a single atom-smasher produce thousands of films. Each film must be carefully examined to look for tell-tale "events" that illuminate something about the strange or ill-known particle. Automatic and electronic methods are being developed to read the films quickly and accurately.

Experiments check the reasoning of creative theorists, and uncover new facts which allow theory to grow and come closer to the truth about the inner universe.



atomic heart could stick together at all, since it was tightly packed with many protons, all positively charged. They should repel one another. All atoms logically should blow apart, and the universe, too.

Obviously the nucleus is powerfully glued together.

Yukawa proposed — and later experiment confirmed — that a main part of the glue was the meson, a particle observed when atoms in the atmosphere were blown apart by cosmic rays speeding in from outer space.

The astonishing — but accepted — idea is that protons and neutrons keep passing mesons back and forth like hot potatoes at almost the speed of light. These are known as pi mesons. The fast exchange introduces a

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Advices Check On Guarantees

Shoppers eyeing appliances as Christmas gifts should double check on the "guarantee" or "warranty" which accompanies them.

Nearly 50 per cent of the total small appliances are purchased

as Christmas gifts, according to Bernice Strawn, extension home management and equipment specialist at Oregon State College.

To protect consumers, the Federal Trade Commission has recently requested that if advertising mentions the word "guarantee" it must clearly state exactly what the guarantee includes. Although industry itself is conducting a campaign for more honest advertising, a few misleading or incomplete statements may creep into claims.

Miss Strawn advises shoppers to ask how long the guarantee lasts, what part or parts of the products are guaranteed, and if any parts are not covered.

The customer should also inquire what he has to do to take advantage of the guarantee—return it or pay charges. Find out who backs the guarantee, the manufacturer or the dealer. Sometimes the guarantee allows for a refund, repair or replacement, but not always, she continues.

Frequently, adjustments depend on how long the appliance has been used and are based on list price rather than the price paid. All in all, what may appear to be a bargain may not really be one when all facts are known, she cautions.

Persons who receive some of these appliances as gifts and find it necessary to exchange them should also check on the warranty offered with the exchange, the specialist reminds.

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