**COSMOLOGIA**

De acordo com os dados da sonda WHAP, a idade do universo é de 13,73 x 109 anos. O satélite Planck define-a como 13,82 x 109.

Baseados na idade das estrelas passa a 14,1 e na idade dos elementos, entre 11,6 e 17,5 x 109..

A pista total auditável em Dn tem a dimensão de 350 triliões de anos (350 x 1012)

Antes disso temos incidentes a 1 quatrilião de anos (1015) e 4 a 7 quatriliões (4 a 7 x 10 15.)

Desde essa altura o universo tem estado em expansão à taxa (constante de Hubble) de 73,2 km/s por mega parsec, isto é, 3 x 1019.km.

A dimensão do universo observável também é tema de disputa entre 13,7 e 180 biliões de anos luz (13,7 a 180 x 109 anos luz.). Mas a dimensão aceite pela ciência é de 93 biliões de anos luz ( 93 x 109 anos luz) isto é, 883 sextiliões de km (883 x 1021.).

72% do universo é constituído por energia escura, 25% por matéria negra e apenas 4,6% de matéria normal.

Esta matéria normal está agrupada em galáxias (cerca de 80 biliões, 80 x 109), estrelas (cerca de 7 x 10 22).

Como cada estrela tem cerca de 1057 átomos, existem cerca de 1079 átomos no universo, ou seja perto de 1080 partículas.

De acordo com CBR o universo iniciou-se há 10303 anos. Sabemos que há 7 quatriliões de anos ele já estava formado. Isso deixa-nos um período de 10288 anos para a formação de todas as partículas.

Isso deixa um tempo de 10208 anos para cada partícula.

Houve um tempo de 10279 para a formação de cada galáxia, um tempo de 10257 para cada estrela e cerca de 10177 para cada átomo.

As fontes agarraram nos Mocos dispersos e provocaram a sua ligação um positivo com um negativo.

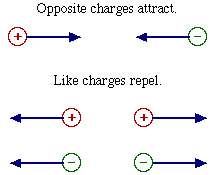
**What Holds an Atom Together**

We've seen that an atom consists of a whole bunch of different kinds of particles. The next logical question (and we do want to be logical, don't we?) is: "What holds it all together?" What makes all this stuff an atom, rather than just a bunch of stuff flying past each other?

Well, there are basically two things that hold it together. Two forces, that is. The first of these has to do with electric charge, something I mentioned on the previous page. Electric charge comes in two varieties: positive and negative. The main carriers of positive charge are protons, while the main carriers of negative charge are electrons. (Within protons and neutrons, the quarks themselves carry charge, but this is only important to us in that the net charge of a proton or neutron is equal to the sum of the charges of all its quarks: zero for a neutron, and a small positive amount for a proton.) Every proton carries exactly the same amount of positive charge, and every electron carries a negative charge exactly opposite that of a proton. There are other particles with electric charge, but they tend to live only a very short time before they decay, and so they're mostly unimportant for atoms.

The significance of electric charge is that it forms the basis for electric force. Any particle with electric charge will exert a force on any other particle with charge. (And vice versa, of course.) And there are two rules describing the electric force.

1. Opposite charges attract; like charges repel.
2. The force gets weaker as the two charges get farther apart.



That is, a proton and an electron will attract each other. The closer they are together, the stronger this attraction will be. Two protons (or two electrons) will repel each other. And again, the closer together they are, the stronger the repulsion. Now the nucleus of an atom is positively charged, while electrons are negatively charged. As a result, a nucleus will attract electrons. These electrons will swarm around the nucleus, and the result is an atom.

Now we haven't explained everything yet. The electric force explains how the electrons are bound to the nucleus of an atom. But we haven't said anything about what holds the nucleus together. The electric force can't account for this, and in fact, the electric force actually works against holding the nucleus together.

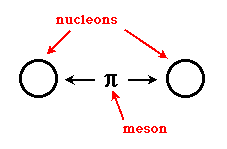
Remember, the nucleus contains neutrons and protons. The neutrons are electrically neutral, and so the electric force won't hold them in. Furthermore, the protons are all positively charged, and so they all repel each other. So if the electric force was the only force involved, you couldn't create a nucleus. You could try to push all those protons and neutrons together, but as soon as you let go, the protons would all shoot away from each other, and the neutrons would drift apart as well. There has to be some other force that holds protons and neutrons together.

Of course, since the electric force is constantly trying to drive the protons apart, the force that holds them all in must be stronger than the electric force. And keep in mind, the electric force gets stronger as charged particles get closer together, and the protons in a nucleus are *very* close together. As a result, the force that holds protons and neutrons together must be *very* strong. Well, in a brilliant stroke of imagination, physicists have named this force "the strong force."

The strong force is a force which attracts protons to protons, neutrons to neutrons, and protons and neutrons to each other. The force has a very short range, and this is the reason the nucleus of an atom turns out to be so small. In addition, the strong force is also responsible for binding the quarks and gluons into protons and neutrons.

So the nucleus of an atom is held together by the strong force, while the electrons are held in the atom by the electric force. If you're more interested in these forces, you might want to try [Dave's Microcosmos](https://webs.morningside.edu/slaven/Physics/micro/index.html).

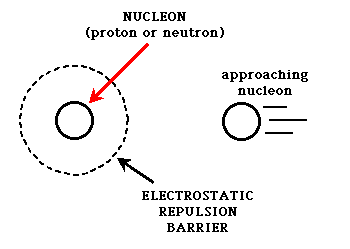
The strong nuclear force is created between nucleons by the exchange of particles called mesons. This exchange can be likened to constantly hitting a ping-pong ball or a tennis ball back and forth between two people. As long as this meson exchange can happen, the strong force is able to hold the participating nucleons togeher.



 The nucleons must be extremely close together in order for this exchange to happen. The distance required is about the diameter of a proton or a neutron.

If a proton or neutron can get closer than this distance to another nucleon, the exchange of mesons can occur, and the particles will stick to each other. If they can't get that close, the strong force is too weak to make them stick together, and other competing forces (usually the electromagnetic force) can influence the particles to move apart.

This is represented in the following graphic. The dotted line surrounding the nucleon being approached represents any electrostatic repulsion that might be present due to the charges of the nucleons/particles that are involved. A particle must be able to cross this barrier in order for the strong force to "glue" the particles together.



In the case of approaching protons/nuclei, the closer they get, the more they feel the repulsion from the other proton/nucleus (the electromagnetic force).

As a result, in order to get two protons/nuclei close enough to begin exchanging mesons, they must be moving extremely fast (which means the temperature must be really high), and/or they must be under immense pressure so that they are forced to get close enough to allow the exchange of meson to create the strong force.

Now, back to the nucleus. One thing that helps reduce the repulsion between protons within a nucleus is the presence of any neutrons. Since they have no charge they don't add to the repulsion already present, and they help separate the protons from each other so they don't feel as strong a repulsive force from any other nearby protons.

Also, the neutrons are a source of more strong force for the nucleus since they participate in the meson exchange. These factors, coupled with the tight packing of protons in the nucleus so that they can exchange mesons creates enough strong force to overcome their mutual repulsion and force the nucleons to stay bound together.

The preceding explanation shows the reason why it is easier to bombard a nucleus with neutrons than with protons. Since the neutrons have no charge, as they approach a positively charged nucleus they will not feel any repulsion. They therefore can easily "break" the electrostatic repulsion barrier to being exchanging mesons with the nucleus, thus becoming incorporated into it.

O **méson** ([pt-BR](https://pt.wikipedia.org/wiki/Portugu%C3%AAs_brasileiro)) ou **mesão** ([pt](https://pt.wikipedia.org/wiki/Portugu%C3%AAs_europeu)) é uma [partícula subatômica](https://pt.wikipedia.org/wiki/Part%C3%ADcula_subat%C3%B4mica) (um [hádron](https://pt.wikipedia.org/wiki/H%C3%A1dron" \o "Hádron)[[1]](#footnote-1)) composta por um [quark](https://pt.wikipedia.org/wiki/Quark) e por um [antiquark](https://pt.wikipedia.org/wiki/Antipart%C3%ADcula" \o "Antipartícula) de [carga de cor](https://pt.wikipedia.org/wiki/Carga_de_cor)oposta.[[1]](https://pt.wikipedia.org/wiki/M%C3%A9son#cite_note-1) Frequentemente, um par de quark e antiquark não ocorre isoladamente, mas, em vez disso, mistura-se com outros de modo a que os quarks fiquem com uma sobreposição de [sabores](https://pt.wikipedia.org/wiki/Sabor_(f%C3%ADsica)) (como sempre, os sabores mais semelhantes em massa misturam-se mais).

Em [física das partículas](https://pt.wikipedia.org/wiki/F%C3%ADsica_das_part%C3%ADculas), **sabor** é um conjunto de [números quânticos](https://pt.wikipedia.org/wiki/N%C3%BAmeros_qu%C3%A2nticos) (ou [simetria](https://pt.wikipedia.org/w/index.php?title=Simetria_(f%C3%ADsica)&action=edit&redlink=1)) que caracteriza diversos tipos de [quarks](https://pt.wikipedia.org/wiki/Quark) e [léptons](https://pt.wikipedia.org/wiki/L%C3%A9pton" \o "Lépton) - duas subfamílias de [férmions](https://pt.wikipedia.org/wiki/F%C3%A9rmion" \o "Férmion) -, os quais seriam indistinguíveis com base em outras propriedades. Portanto, os sabores permitem distinguir certas classes de partículas cujas demais propriedades ([carga elétrica](https://pt.wikipedia.org/wiki/Carga_el%C3%A9trica), [interatividade](https://pt.wikipedia.org/wiki/Intera%C3%A7%C3%A3o_fundamental) etc.) são similares. Na [teoria eletrofraca](https://pt.wikipedia.org/wiki/Intera%C3%A7%C3%A3o_eletrofraca), tal simetria é uma [simetria de gauge](https://pt.wikipedia.org/w/index.php?title=Simetria_de_gauge&action=edit&redlink=1) e se manifesta justamente na mudança do sabor. Na [cromodinâmica quântica](https://pt.wikipedia.org/wiki/Cromodin%C3%A2mica_qu%C3%A2ntica), é uma [simetria global](https://pt.wikipedia.org/w/index.php?title=Simetria_global&action=edit&redlink=1), também chamada [quiral](https://pt.wikipedia.org/wiki/Quiralidade_(f%C3%ADsica)).

A Primeira Lei da Termodinâmica se ocupa daquilo que é necessário para que trabalho seja transformado em calor.

Tem como fundamento o princípio da conservação de energia, que é um dos princípios mais importantes da Física.

Essa conservação de energia acontece sob as formas de calor e de trabalho. Ela faz com que um sistema possa conservar e transferir energia, ou seja, a energia pode sofrer aumento, diminuição ou permanecer constante.

A Primeira Lei da Termodinâmica é expressa pela fórmula

Q = τ + ΔU

Onde,

Q: calor

τ: trabalho

ΔU: variação da energia interna

Desta forma, seu fundamento é: o calor (Q) resulta da soma de trabalho (τ) com a variação da energia interna (ΔU).

Ela também pode ser encontrada da seguinte forma:

ΔU = Q - W

Onde,

ΔU: variação da energia interna

Q: calor

W: trabalho

O fundamento resulta no mesmo: a variação da energia interna (ΔU) resulta do calor trocado com o meio externo menos o trabalho (W) realizado.

1. **Hádron** ([pt-BR](https://pt.wikipedia.org/wiki/Portugu%C3%AAs_brasileiro)) ou **hadrão** ([pt](https://pt.wikipedia.org/wiki/Portugu%C3%AAs_europeu)) (do [grego](https://pt.wikipedia.org/wiki/L%C3%ADngua_grega) ἁδρός, [transl.](https://pt.wikipedia.org/wiki/Translitera%C3%A7%C3%A3o" \o "Transliteração) *hadrós*, "forte", "robusto"), na [física de partículas](https://pt.wikipedia.org/wiki/F%C3%ADsica_de_part%C3%ADculas), é uma [partícula composta](https://pt.wikipedia.org/wiki/Part%C3%ADcula_composta), formada por um estado ligado de [quarks](https://pt.wikipedia.org/wiki/Quark). Os hádrons, que incluem os [bárions](https://pt.wikipedia.org/wiki/B%C3%A1rion" \o "Bárion) e os [mésons](https://pt.wikipedia.org/wiki/M%C3%A9son" \o "Méson), mantêm sua coesão interna devido à [interação forte](https://pt.wikipedia.org/wiki/Intera%C3%A7%C3%A3o_forte).[[1]](https://pt.wikipedia.org/wiki/H%C3%A1dron#cite_note-1) [↑](#footnote-ref-1)