Nuclear fusion.

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Abstract. *In the present paper we show, that leptons (electron, muon, tau), W + - Z bosons and neutrinos (electron neutrino , muon neutrino, tau neutrino) can be replaced with electron moving at different speeds from 0.1c up to 0.999.. c . When four protons fuse to become one helium nucleus, two of which must be converted into neutrons, and each such transition depends on the penetration of the two electrons from the Universe, to the interior of the star . Penetration 10^{38} to 10^{58} of high energy electrons from the Universe to the interior of the star, transferred huge amounts of energy from the Universe into a small space of the star. This huge cosmic energy is responsible for thermonuclear fusion.*

Currently prevailing opinion that the star itself is the source of the nuclear fusion powering the star.

In fact, without a high-energy electrons from other stars of the Universe, single star can not be able to a nuclear fusion, because without a high-energy electrons from other stars, her stellar protons cannot be transform into her neutrons.

Keywords: mass, kinetic energy, electron, nuclear fusion, neutron, neutronization, neutrino.

Introduction

Neutronization (physics, astronomy): The process, such as within a collapsing star, in which protons and electrons fuse to form neutrons and release neutrinos.

Supernova (astronomy) : A star which explodes, increasing its brightness to typically a billion times that of our sun, though attenuated by the great distance from our sun. A Type Ia supernova is a sub-category of supernovae, which in turn are a sub-category of cataclysmic variable stars, that results from the violent explosion of a white dwarf star. A white dwarf is the remnant of a star that has completed its normal life cycle and has ceased nuclear fusion.Some leave only debris (Type I); others fade to invisibility as neutron stars (Type II).

Fusion is one of nature's most spectacular achievements. Billions and billions of fusion furnaces, the Sun among them, are flaring in the Universe, creating light and energy.

Some seventy years ago scientists understood the physics behind this wonder: the Sun and stars *transmute* matter, patiently and tirelessly transforming Hydrogen nuclei into Helium atoms and releasing huge amounts of energy in the process.

With this knowledge came the ambition to reproduce, here on Earth, what was happening in the innumerable stars of the Universe. But harnessing the energy of the stars was to prove a formidable task, more complex and arduous than anticipated.

Creating the required conditions for fusion on Earth is very difficult. For nuclear weapons, some of the energy released by an atomic bomb is used to compress and heat a fusion fuel to the point of "ignition". At this point, the energy released in the fusion reactions is enough to briefly maintain the reaction. Fusion-based nuclear power experiments attempt to create similar conditions using less dramatic means, although to date these experiments have failed to maintain conditions needed for ignition long enough for fusion to be a viable commercial power source.

Research into developing controlled thermonuclear fusion for civil purposes also began in earnest in the 1950s, and it continues to this day. Two projects, the National Ignition Facility and ITER are in the process of reaching breakeven after 60 years of design improvements developed from previous experiments.[14]

Current ideas

Neutron stars rotate extremely rapidly after their creation due to the conservation of angular momentum; like spinning ice skaters pulling in their arms, the slow rotation of the original star's core speeds up as it shrinks. A newborn neutron star can rotate several times a second; sometimes, the neutron star absorbs orbiting matter from a companion star, increasing the rotation to several hundred times per second. The most rapidly rotating neutron star currently known, PSR J1748-2446ad, rotates at 716 revolutions per second.[1]

The core collapses in on itself with velocities reaching 70,000 km/s (0.23c)[2], resulting in a rapid increase in temperature and density. Through photodisintegration , gamma rays decompose iron into helium nuclei and free neutrons, absorbing energy, while electrons and protons merge via electron capture , producing neutrons and electron neutrinos, which escape. A further release of neutrinos carries away much of the thermal energy, allowing a stable neutron star to form (the neutrons would "boil away" if this cooling did not occur).[3]

About 10^{46} joules of gravitational energy—approximately 10% of the star's rest mass—is converted into a ten-second burst of neutrinos, which is the main output of the event. [6] [7] These carry away energy from the core and accelerate the collapse, while some neutrinos are absorbed by the star's outer layers and provide energy to the supernova explosion. [8]

The inner core eventually reaches typically 30 km diameter, [6] and a density comparable to that of an atomic nucleus, and further collapse is abruptly stopped by strong force interactions and by degeneracy pressure of neutrons. The infalling matter, suddenly halted, rebounds, producing a shock wave that propagates outward. Computer simulations indicate that this expanding shock does not directly cause the supernova explosion; [6]rather, it stalls within milliseconds[8] in the outer core as energy is lost through the dissociation of heavy elements, and a process that is not clearly understood is necessary to allow the outer layers of the core to reabsorb around 10^{44} joules of energy, producing the visible explosion. [2]

Theory

Calculation of the kinetic energy of a body moving at the velocity of v , [4] p. 51-52:

$$T_{kin} = \frac{mc^2}{\cos^2 \vartheta}\left[\ln\left|1 - \frac{v}{c}\cos\vartheta\right| + \frac{\frac{v}{c}\cos\vartheta}{1 - \frac{v}{c}\cos\vartheta}\right]$$

while ϑ isn't $\frac{\pi}{2}$, $\frac{3\pi}{2}$

For $\vartheta = 0°$ we have the kinetic energy in the direction of motion

$$T_{kin_d} = mc^2\left[\ln\left|1 - \frac{v}{c}\right| + \frac{\frac{v}{c}}{1 - \frac{v}{c}}\right]$$

For $\vartheta = 180°$ we have the kinetic energy against the direction of motion

$$T_{kin_{ad}} = mc^2\left[\ln\left|1 + \frac{v}{c}\right| - \frac{\frac{v}{c}}{1 + \frac{v}{c}}\right]$$

kinetical energy/of electron / E_e=mc^2 [ln |1-v/c|+ (v/c) / (1-v/c)] in direction of motion of electron (from the Universe, to the interior of the star), where v is velocity of electron

kinetical energy/of wave =of electron neutrinos /=

E_w = mc^2 [ln |1+v/c|- (v/c) / (1+v/c)] against direction of motion of electron (from the interior of the star, to the Universe), where v is velocity of electron

Star neutrinos originate from the nuclear fusion powering the stars. The details of the operation of the star we can explain.

1. When electrons from the Universe have velocity v = 0,6c , then

radius of force reach of electron r_e [4] p. 55-61:

$\mathbf{r_e}$ =7,7242296915076524984672268696567e-16m in direction of motion of electron

from the Universe, to the interior of the star,

$\mathbf{r_e}$ =7,5933174273225751416275418610272e-14m against direction of motion of electron

(from the interior of the star, to the Universe / wave =of electron neutrinos /

for v/c= 0,6 ......electron

2.When electrons from the Universe have velocity v = 0,9953c , then

radius of force reach of electron r_e :

$\mathbf{r_e}$ =2,9852697367995728469528649797656e-21m in direction of motion of electron from the Universe, to the interior of the star,

$\mathbf{r_e}$ =5,8533905779558232539269262326763e-14m against direction of motion of electron (from the interior of the star, to the Universe / wave =of muon neutrinos /

for v/c=0,9953 .... muon

3.When electrons from the Universe have velocity v = 0,99971c , then

radius of force reach of electron $\mathbf{r_e}$ =2,840401487397554751560630135382e-24m in direction of motion from the Universe, to the interior of the star,

$\mathbf{r_e}$ =5,8375618415212342167582430481493e-14m against direction of motion of electron (from the interior of the star, to the Universe / wave =of tauon neutrinos /

for v/c=0,99971 ...... tauon

The proposed views

In short, when four protons fuse to become one helium nucleus, two of which must be converted into neutrons, and each such transition depends on the penetration of the two electrons from the Universe, to the interior of the star .

Penetration 10^{38} to 10^{58} of high energy electrons from the Universe to the interior of the star, transferred huge amounts of energy from the Universe into a small space of the star.(Also at the beginning of ignition stars in the nebulae too ... there where stars are born).

This huge cosmic energy is responsible for thermonuclear fusion.

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In fact, without a high-energy electrons from other stars of the Universe, single star can not be able to a nuclear fusion, because without a high-energy electrons from other stars, her stellar protons cannot be transform into her neutrons.

The idea that inside the star, the mass converted to energy and energy into mass, without regard to high-energy electrons from the surrounding Universe, so finally falls. It is unsustainable.

Neutronization, i.e. injection of free electrons to protons to form neutrons and neutrinos, as a consequence of the Pauli principle can therefore simply replace with the above considerations. Although the inverse beta-decay is common to both considerations, the qualitative difference is obvious.

The free electrons in the stars are replaced by high-energy electrons from the Universe and neutrinos are replaced by waves which spread in the opposite direction to the movement of high-energy electrons from the Universe, i.e. by kinetic energy / of wave = of neutrinos / = Ew = mc2 [ln | 1 + v / c | - (v / c) / (1 + v / c)] against direction of motion of electron (from the interior of the star, to the Universe), where v is velocity of electron.

Moreover, formation of a supernova is only possible, if the increase the number of penetrating high-energy electrons from the Universe.

At the end of life star :

1. high-energy electrons from the Universe are penetrating into the star,

2. by waves (= by electron neutrinos) propagated from inside of star to her surface , the star expands, more and more. More and more active are mutual repellent protons of star. In combination with neutrino waves, star more and more expands.

Gradually grows, its radius will expand about 100 times (R_{RG} = 100 R_S ... Arcturus) and due to conservation of angular momentum (L = I*omega = const) decreases rotation of the magnified star from $omega_s = 2{,}8 * 10^{-6}$ Hz on $omega_{RG} = 10^{-8}$ Hz. This creates a Red Giant.

This makes that the high-energy electrons from the Universe easily penetrate into the interior of stars (electrons have a small radius of force reach $\mathbf{r_e}$ **=**2,8404014873975547515606301353 82e-24m in direction of motion from the Universe) and in particular the impact of 10^6 times more (since the volume of Red Giant is a $100^3 = 10^6$ times greater).

Therefore into the interior of Red Giant can easily penetrate slower electrons from the universe too. Total number all electrons from the Universe is approximately 10^7 times more than in the middle of life stars. As a result, inside the Red Giant arises approximately 10^7 times more neutrons per second.

After some time, almost all protons inside the Red Giant will turn into neutrons (repulsive force of protons is replaced without force, or a weak attractive force of neutrons respectively).

After the conversion of protons into neutrons, leads to of neutrons concentration and a very dense neutron star with a radius of R_{ns} = 10 000 km, and due to conservation of angular momentum,

neutron star spinning at $omega_{ns}$ = 1 Hz to 716 Hz .[1]

Together with this reduction of the Red Giant in neutron star, arises emission neutrino waves in the opposite direction of movement of electrons from the Universe.

This creates a shock wave which ejects the remnants of star into Universe - thus creating a circular cloud of gas that is growing with time after the supernova explosion.

The remaining protons, which did not create with electrons from the Universe neutrons,

create hydrogen atoms - electron capture (K-capture).

And either because some electrons from the Universe have a lower speed of 0.003 c - 0.6c or because they are located in areas distant from the center of the star where the pressure is significantly lower. These hydrogen atoms are entrained by the neutrino waves propagating from inside of the star out into Universe.

Discussion

The greater the velocity of the electrons, the smaller the radius of force reach of electron r_e ,

the easier and more likely it can penetrate in star.

In short, when four protons fuse to become one helium nucleus, two of which must be converted into neutrons, and each such transition depends on the penetration of the two electrons from the Universe, to the interior of the star.

How to easily build a power plant where nuclear fusion can take place?

1. On Earth - in the source of protons send high-energy electrons from electron accelerators at CERN,... Of course, it is necessary to eliminate or at least mitigate the wave of neutrinos, otherwise there would be a blast. This is also the biggest problem of the safe implementation of nuclear fusion.

2. On the moon: into source of protons to leave penetrate high-energy electrons from the Universe.

3. Perhaps on Earth (Antarctica) under the ozone hole to place the source of protons into which penetrate high-energy electrons from the Universe.

In addition, exist several other options, which after reading this article, the reader certainly finds.

References

[1] Jason W.T. Hessels (McGill), Scott M. Ransom (NRAO), Ingrid H. Stairs (UBC), Paulo C.C. Freire (NAIC), Victoria M. Kaspi (McGill), Fernando Camilo (Columbia)A Radio Pulsar Spinning at 716 Hz Astrophysics (astro-ph) DOI: 10.1126/science.1123430 arXiv:astro-ph/0601337v1

[2] Fryer, C. L.; New, K. C. B. (2006-01-24). "Gravitational Waves from Gravitational Collapse". *Living Rewievs in Relativity* **6** (2). Retrieved 2006-12-14.

[3]Mann, A. K. (1997). *Shadow of a star: The neutrino story of Supernova 1987A*. W.H. Freeman. pp. 122. ISBN 0716730979.

[4] L. Vlcek : New Trends in Physics, Slovak Academic Press, Bratislava 1996 ISBN 80-85665-64-6. Presentation on European Phys. Soc.10th Gen. Conf. – Trends in Physics (EPS 10) Sevilla , E 9 -13 September 1996.

[5] Woosley, S.; Janka, H.-T. (2005). "The Physics of Core-Collapse Supernovae". *Nature Physics* **1** (3): 147–154. arXiv:astro-ph/0601261. Bibcode 2005NatPh...1..147W. doi:10.1038/nphys172.

[6]Barwick, S.; *et al.* (2004-10-29). “APS Neutrino Study: Report of the Neutrino Astrophysics and Cosmology Working Group”. American Physical Society. Retrieved 2006-12-12.

[7] Hayakawa, T.; *et al.* (2006). "Principle of Universality of Gamma-Process Nucleosynthesis in Core-Collapse Supernova Explosions". *Astrophysical Journal Letters* **648** (1): L47–L50. Bibcode 2006ApJ...648L..47H. doi:10.1086/507703.

[8] S. Myra, E.; Burrows, A. (1990). "Neutrinos from type II supernovae- The first 100 milliseconds". *Astrophysical Journal* **364**: 222–231. Bibcode 1990ApJ...364..222M. doi:10.1086/169405.

[9] F. Kirchner : Über die Bestimmung der spezifischen Ladung des Elektrons aus Geschwindigkeitsmessungen, Ann. d. Physik [5] **8**, 975 (1931)

[10] F. Kirchner : Zur Bestimmung der spezifischen Ladung des Elektrons aus Geschwindigkeitsmessungen , Ann. d. Physik [5] **12**, 503 (1932)

[11] Ch. T. Perry, E.L. Chaffee : A DETERMINATION OF e/m FOR AN ELECTRON BY DIRECT MEASUREMENT OF THE VELOCITY OF CATHODE RAYS , Phys.Rev.**36**,904 (1930)

[12] J.K. Shultis, R.E. Faw (2002). *Fundamentals of nuclear science and engineering*. CRC Press. p. 151. ISBN 0824708342.

[13] Hans A. Bethe, "The Hydrogen Bomb", *Bulletin of the Atomic Scientists*, April 1950, page 99. Fetched from books.google.com on 18 April 2011.

[14] "Progress in Fusion". ITER. Retrieved 2010-02-15.