Tachyons in Astrophysics : Dark Matter, the Radius and Mass of the Neutron Star SS433

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Abstract

In paper I (Steyaert 1999) we showed that the tachyon ($v>c$) concept was a valid one with numerous applications in astrophysics. If every star is emitting a copious amount of tachyons, one for each central photon, then it could well be that the dark matter problem is solved by energetic tachyons surrounding the Galaxy and the cluster of galaxies. At the beginning of the years 1980, nuclear physicists have obtained a value of the compressibility parameter K of nuclear matter. They found a value of 300 ± 25 MeV at variance with the commonly accepted value of 210 ± 30 MeV.
In this short note we want to show that it is possible by combining the observation of the jet at 0.2601 c ejected by SS433 with parameters of the neutron stars to determine K by an other way and to find again a value around 300 MeV. Moreover the radius and mass of the neutron star imbedded in SS433 are found to be 11.4 R_{sun} and 2.288 M_{sun} respectively.

Keywords : tachyon, quark, neutron star, black hole, dark matter

Radius and Mass of the Neutron Star SS433

The SS433 system has two jets of bradyonic ($v<c$) material ejected at the precise final velocity 0.2601 c , where c is the speed of light. This speed has been deduced by relativistic slowing down of clocks (Margon 1984). We assume that the fundamental process giving rise to the initial velocity is the tachyo-electric effect (I), probably observed by us in a NaI(Tl) detector, when gamma rays are absorbed by many centimeters of copper and giving rise to an abnormal peak centered at 170 ± 2 keV corresponding to electrons recoiling with a velocity of 0.661 c . Close to the surface of the central star, gamma rays produced by infalling matter, would be "converted" by the above effect into electrons at 0.661 c . These electrons would pump the surrounding matter at the same velocity and then decelerate into the gravitational field of the star.

For a star of mass M, radius R smaller than the observation radius r , one calculates $R(M/M_{sun})$ by equating the difference in total energy E to the difference in gravitational potential energy for any mass m:

$$E_R - E_r = \gamma_R\, m\, c^2 - \gamma_r\, m\, c^2 = - G\, m\, M\, (1/r - 1/R) \qquad (1)$$

and $\gamma_R - \gamma_r = G\, M\, (1/R - 1/r)\, c^2$ (2)

For $r >> R$, and the values $\gamma_R = 1.3327(39)$, $\gamma_r = 1.03565(3)$, $G\, M_{sun} / c^2 = 1476.7 \pm 1.5$ m one finds for the radius of the star:

$$R\,(km) = (4.97 \pm 0.066)\, M/M_{sun} \qquad (3)$$

For SS433, from the above slowing down mechanism and formula, one can relate linearly mass and radius:

$$M/M_{sun} = 0.2005\, R\,(km) \qquad (4)$$

An other relation could be obtained from the equation of state for the maximum mass of neutron stars (Prakash 1988). We have extrapolated quadratically the mass/radius relation from the table of (Prakash 1988) for an incompressibility coefficient $K_0 > 240$ MeV. The only relation that crosses the straight line for the above M/M_{sun} is given by:

$$M/M_{sun} = -14.05 + 2.83\, R - 0.12\, R^2 \qquad \text{with } R \text{ in km.} \qquad (5)$$

The case of the pure neutron star is well described by (M/M_{sun}, R) taking the values (1.95,9.895), (2.10,10.318), (2.24,10.933) for K_0 = 120, 180 and 240 MeV respectively.

Two intersections take place among the loci of representative curves.

R1 = 10.059 km,	M1 = 2.016 M_{sun},	K1 = 145 MeV	(6)
R2 = 11.418 km,	M2 = 2.288 M_{sun},	K2 = 265 MeV	(7)

The first solution presents standard mass and radius for a neutron star with a soft compressibility. The second one gives a stiff compressibility closer to the value (Sharma 1988) obtained from giant monopole resonance (GMR) studies, i.e. 300 ± 25 MeV.(The GMR is the motion of neutrons relative to protons in a nucleus). The neutron star radius is close to the most recent data (Glendenning 2001).

Two-body interactions through tachyon exchange has been investigated by Maccarrone and Recami (1980). In that domain we investigated experimentally the elastic diffusion of alpha particles by various nuclei (Jodogne 1962)(Lega 1971). A resonance at 20.5 MeV has been found independent of the nuclei. This could correspond to a pseudo-mass squared $M^2 = 2\ m\ T = 2\ .\ 4\ .\ 938\ .\ 20.5\ MeV^2 = 153832\ MeV^2$; M = 392 MeV (a tachyonic quark ?)

Dark Matter

One can thus conclude that neutron star's nuclear matter compressibility is compatible with the one obtained from nuclear reaction data and that the tachyo-electric effect could be responsible for the ejection of matter. Moreover a precise value is obtained for maximum mass and radius of the neutron star inside the peculiar object SS433 coming close to the concept of a white hole : everything falling on it is ejected.
The black hole has the light-cone inclined on the horizon so the bradyons are absorbed whereas the tachyons are free to escape classically. We have seen in (I) that the Sun is probably emitting a large amount of tachyons; the same situation could be present for every star or hole. This big quantity of energy-momentum could fill the galaxies, the clusters, the Universe and possibly be identified with Dark Matter (Smith 2000)(Taylor 2001) and Dark Energy (Davis 2001). Down to Earth, the climate could be influenced by the tachyonic Sun (Kerr 1991)

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