Missing Neutrinos and Simple QED

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Introduction

The sun produces energy upon fusion of hydrogen atoms. Under gravitational collapse, the high temperature at the center of the sun ionizes hydrogen atoms into a plasma of protons and electrons, but is not sufficient to initiate fusion. In classical physics, two protons cannot fuse because of Coulomb repulsion that poses a problem to fusion as the source of solar energy. In 1928, the probability of fusion as two protons get close to each other was considered impossible. To overcome the improbability of protons fusing, Gamow (1) invoked QM to give a non-zero probability of two protons overcoming Coulomb repulsion and momentarily could be close enough to fuse. QM stands for quantum mechanics. About a decade later, Bethe (2)showed the basic nuclear processes by which stars fuse hydrogen into helium in stellar interiors to be the P-P chain reaction. For a pair of hydrogen atoms, the energy E required to initiate fusion is,

2 H = 2 He + electron + neutrino + E

One fusion reaction produces one neutrino. To initiate fusion, the standard solar model was a sun with a central temperature T = 15 million degrees K corresponding to EM energy E of about 2 keV, where E = 1.5 kT and k is Boltzmann's constant. Since then, hydrogen fusion is generally thought to require E > 2 keV, but is not available in gravitational collapse.

In 1964, Davis showed (3) by experiment the neutrinos produced were found to be fewer, about 1/ 3 the number predicted. The standard model of neutrinos is a massless particle moving at the speed of light. Over the next decades, however, repeated experiments and predictions showed a similar deficit of neutrinos. This dilemma referred to as the Missing Neutrinos Problem was resolved by revising the standard model of the massless neutrino to consist of 3 types: electron , muon and tau, each having different, but small masses. Moreover, the neutrino was allowed to oscillate from the electron type in the sun to muon or tau types on its way to the Earth. Since the sun only produces electron neutrinos, and since early experiments detected only electron neutrinos, the Missing Neutrino Problem was thought resolved by claiming the missing 2/3 of muon and tau neutrinos were just not detected. More recently, SNO experiments (4) that measured all neutrino types: electron, muon, and tau did not show a deficit thereby confirming the standard neutrino model modified for oscillations among neutrino types. SNO stands for Sudbury Neutrino Observatory.

However, the modified neutrino model having oscillating small masses for electron, muon, and tau types is not appealing because underlying physical mechanisms are not well understood. In 2017, Shrair (5) and others argued neutrinos need not oscillate on their way to Earth to account for the deficit. In fact, the number of solar neutrinos detected from the above experiments is the actual rate of solar electron neutrinos. What this means is there is no Missing Neutrino Problem and the standard massless neutrino model is correct while the standard solar model needs revision.

Proposed Solar Model

In the proposed solar model, fusion produces 1/3 of the expected number of neutrinos, but requires an additional source of non-fusion energy to supply the remaining 2/3 of the sun's power. Gravitational collapse alone having temperatures T = 6.8 million K or E = 0.87 keV can be dismissed as fusion requires T = 15 million K or E = 2 keV. A non-fusion energy source to supplement gravity collapse called simple QED is proposed as illustrated in Figure 1. Simple QED is based on real photons altogether different from Feynman's QED based on virtual photons .

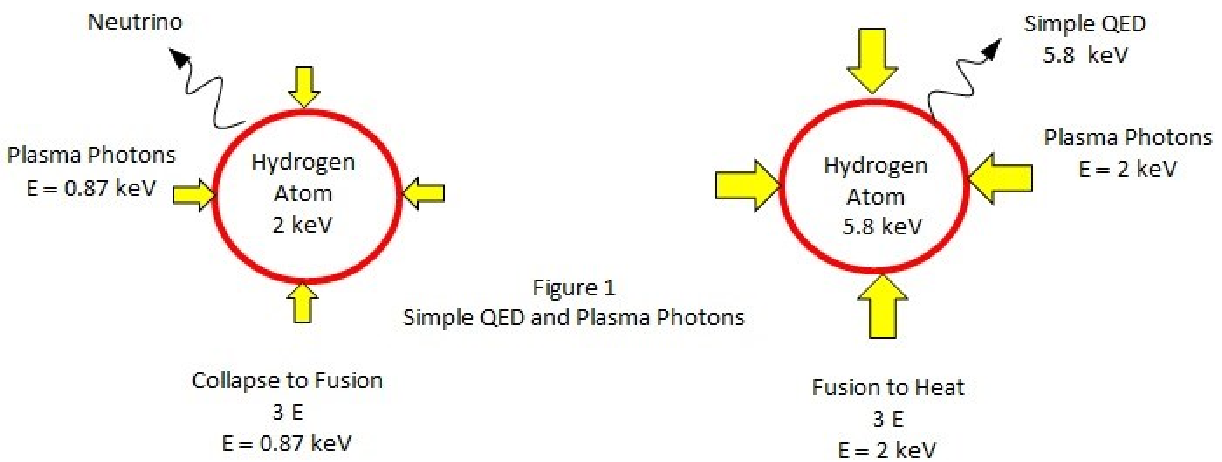

Figure 1
Simple QED and Plasma Photons

Classically, atoms have heat capacity allowing the solar collapse temperatures of 6.8 million K to increase to 15 million K and initiate fusion. But simple QED argues fusion does not occur because QM precludes the atom from having the heat capacity (6) to increase from solar collapse to fusion temperatures. What this means is fusion occurs because EM energy at 2 keV excites the hydrogen atoms and not temperatures of 15 million K, i.e., the EM energy E of the 15 million K bath is, E = 1.5 kT = 2 keV. Similarly, EM energy of gravitational collapse at E = 0.87 keV cannot initiate fusion. Therefore, fusion begins in solar collapse as hydrogen atoms absorb 3 plasma 0.87 keV photons accumulating to the 2 keV level to initiate fusion. In simple QED, the EM confinement of plasma energy absorbed by the atom occurs (6) because the atom's high surface to volume ratio requires all plasma photons to be deposited on the atom surface, while thermal expansion to relieve the EM confinement is precluded by QM denying an increase in surface temperature. Neutrinos are emitted for all 2 keV fusion events, but otherwise are not emitted. Hence, neutrinos are emitted from the 2 keV fusion heat Qo supplied to the sun is 1/3 of the total solar energy Q , i.e., Qo = 1/3 Q. Further absorption of 0.87 keV photons from solar collapse increase EM energy, but neutrinos are not emitted. Hence, the remaining 2/3 Q solar heat is produced by simple QED converting 6 solar collapse photons at 0.87 keV to 5.8 keV photons.

The simple QED energy limit for the hydrogen atom is depicted in relation to energy levels of gravity collapse and hydrogen fusion in Figure 2. Gravitational collapse produces a bath of 0.87 keV radiation that upon absorption by hydrogen atoms emits 5.8 keV photons that can initiate fusion at another atom over a distance and does not require momentary proximity by QM. Like an atom under CW laser irradiation, the EM energy absorbed by the atom surface increases until a higher energy state is excited, but the hydrogen atom is absent X-ray level electron states. However, the size dependent simple QED state at 5.8 keV is available. Upon filling to the 5.8 keV level with 0.87 keV plasma photons, the 5.8 keV energy is emitted to be absorbed in the sun thereby providing the remaining 2/3 of non-fusion solar power.

Figure 2
Simple QED
Fusion and approach of Hydrogen Atoms

The Planck energy E of the simple QED quantum state corresponds to a non-thermal wave standing across the atom diameter d, i.e., E = hc/2d, where h is Planck's constant and c the speed of light. For hydrogen having diameter d = 106 pm, E = 5.8 keV . In effect, simple QED converts the Qo = 2 keV fusion energy into to total solar heat Q = 5.8 keV, i.e., Q = (5.8)/3 + 2 (5.8) /3 = 5.8 keV. No additional neutrinos are emitted during simple QED so that the number No of neutrinos measured is 1/3 of that expected if the remaining 2/3 of non-fusion energy also emits neutrinos.

Conclusions

The Missing Neutrino Problem need not be resolved by oscillations among non-zero rest masses for the electron, muon, and tau, at least until the underlying physical mechanisms are understood. In contrast, simple QED is based on the established Planck law of QM which requires the heat capacity of the hydrogen atom to vanish meaning the 15 million K temperature of the sun is meaningless as a basis for understanding of solar fusion, and instead fusion in the sun should be considered initiated by EM energy at 0.87 keV. Nothing could be simpler. The central sun region is likened to a 0.87 keV CW laser irradiating hydrogen atoms with a size dependent quantum state at 5.8 keV.

There is no Missing Neutrino Problem. The number of neutrinos emitted is the number of 2 keV EM fusion events and the 5.8 keV the is the upper limit of EM solar energy emitted, the number of neutrinos emitted is 2/5.8 = 0.34 or about 1/3 of that expected if neutrinos were emitted for all solar EM energies.

The standard model of the massless electron neutrino in the sun is correct, but the standard model of solar fusion needs revision for simple QED.

The difficulty that atoms cannot get close to each other to initiate fusion thought resolved by QM allowing fusion to occur over a short time is superseded by simple QED allowing 5.8 keV photons to initiate fusion at another atom over a finite distance.

REFERENCES

1. G. Gamow, Zur Quantentheorie der Atomzertrümmerung, Zeit. fur Physik 52, 510 (1928)
2. H.A. Bethe, Energy production in Stars, Phys. Rev. 55, 436 (1939).
3. R. Davis Jr., Solar Neutrinos. II. Experimental, Phys. Rev. Lett. 12, 302 (1964).
4. The SNO Collaboration, Direct Evidence for Neutrino Flavor Transformation from Neutral-Current 5. Interactions in the Sudbury Neutrino Observatory, 19 April 2002.
5. J. S. Shrair, The Solar Neutrino Problem Has Not Been Solved, See https://www.researchgate.net/publication/316595650
6. T. Prevenslik, Simple QED Applications, www.nanoqed.org, 2016 - 2019