

New Theory of Nuclear Fusion Processes in Sun and other Stars

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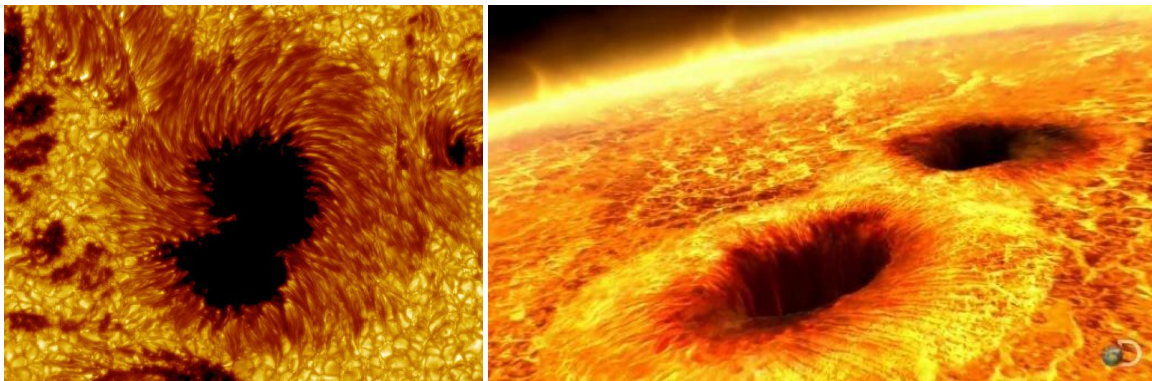
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Abstract

Currently accepted theory about the sun holds that it is a giant nuclear fusion reactor powered by its hot core having extremely high pressures and temperatures (~ 15MK). Even though this theory accounts for energy generation of the sun and elements formation by fusion processes from a hot plasma of Hydrogen and Helium, the theory fails to explain many of the observed phenomenon in a rational manner. Its chief shortcomings being its inability to fully explain the actual process of fusion in the core region rationally without using vague assumptions, high temperatures of corona (~ 1-2 MK) around the sun whilst surface sun temperatures being less than 6000K, failure to account for the formation of coronal loop structures, failure to adequately explain the activity we observe on the sun in the form of CME's and sun spots, unable to explain the causes of fast and slow solar winds among others. A new Theory is proposed which explains all the observed phenomenon of the sun including explanations of all the above mentioned shortcomings of the old fusion model and fits all the pieces of the jigsaw puzzle together(of the workings of sun) using our current understanding of the forces of electromagnetism. This theory provides a direct rational explanation of all observed phenomenon of the sun without resorting to any vague assumptions.

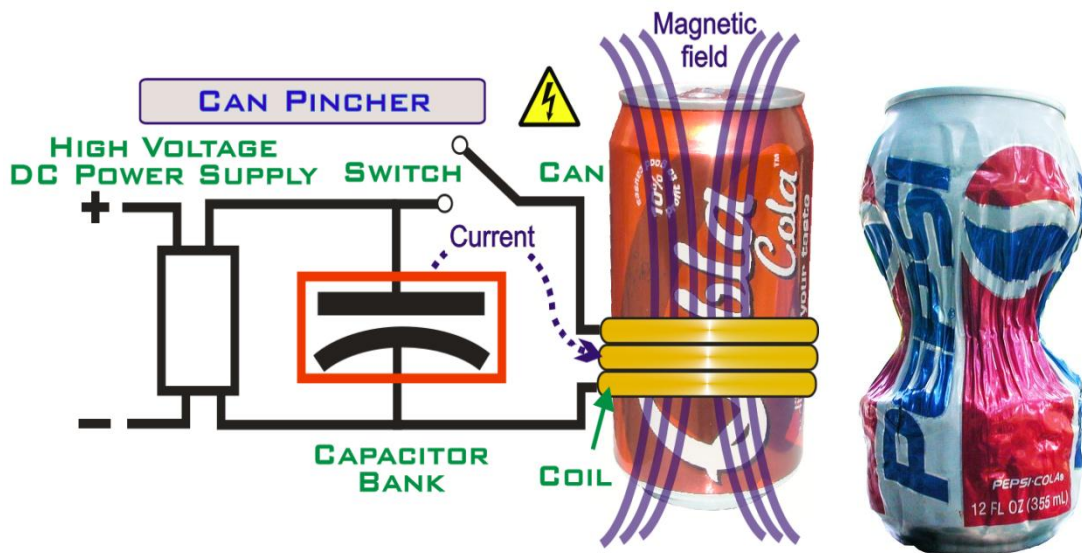
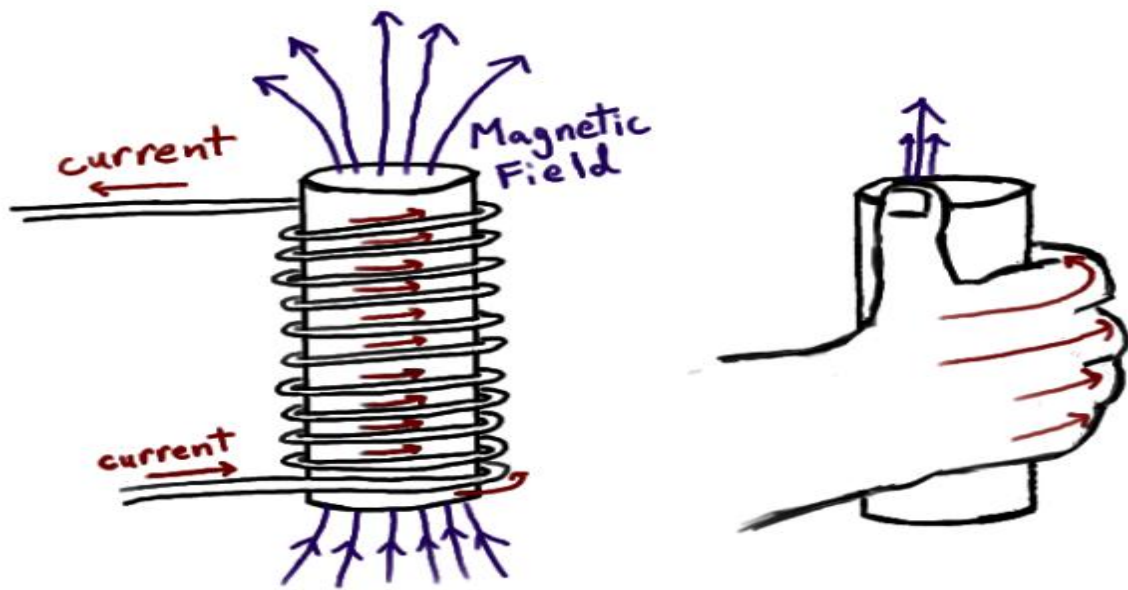
New theory of fusion in Sun and other Stars

As the star comes into existence by electromagnetic Z-Pinch mechanism it's a uniform ball of ionised Hydrogen\Helium plasma, which immediately starts cooling by recombination of plasma at its outer surface causing it to shine by releasing energy. This is straight forward phase transition of plasma to gas by release of energy. Initial energy (Current Density) imparted during this Z-Pinch is high and this will cause the star to glow bluish at the start of its life and as it continues to radiate energy its temperature decreases changing its luminosity (from bluish towards yellow). Initially plasma is primarily re-combing back into Hydrogen and Helium gas and these gases will start to form an outer layer of the star much like an atmosphere due to being held by gravity. This atmospheric layers of gases will give rise to weather type turbulent phenomenon on the surface of the star (much like hurricanes\tornadoes on earth but much more extreme in magnitudes) which will move hot ionised plasma on the surface in hurricane like structures causing massive flows of currents in these circular flows of plasma resulting in huge electromagnetic fields being generated.

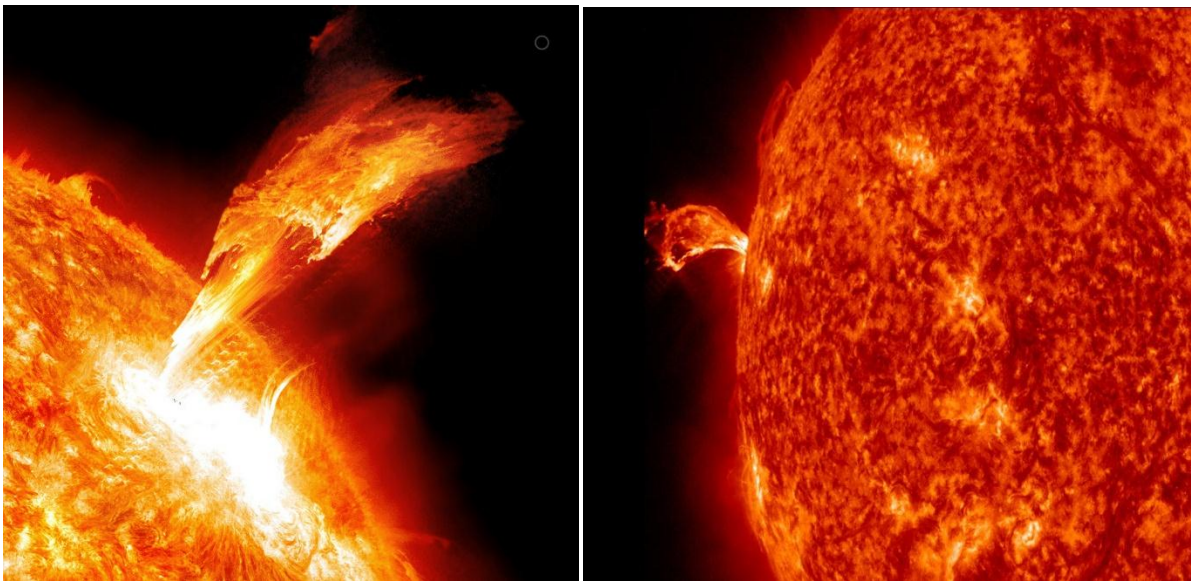


These rapidly rotating circular flows of plasma (Ionised material) will generate huge currents resulting in massive pinch effect in the centre of moving currents (Lorenz Forces) and generating strong magnetic fields perpendicular to surface of the sun. This electromagnetic process can be easily understood by applying Fleming's right hand rule to determine the direction of forces acting in that zone. This hurricane like structures generating massive electromagnetic fields will explain what we see on the surface of the sun. Solar flares and dark sun spots are two faces of

the same phenomenon on opposite sides. Circular plasma currents rotating in opposite directions (clockwise/anticlockwise) will result in two different outcomes on the surface of the sun i.e. either a deep hole (sun spot) pushing material deep inside the star along its magnetic force or an ejection (Solar Flare) of material from the star in accordance with the direction of electromagnetic forces acting on the circular rotating plasma field.



What we observe is that there is continues flow of plasma material through these electromagnetic fields on the surface of the Sun occurring and many of these fields making magnetic connections among themselves creating circular arcs of flowing plasma material among these fields .

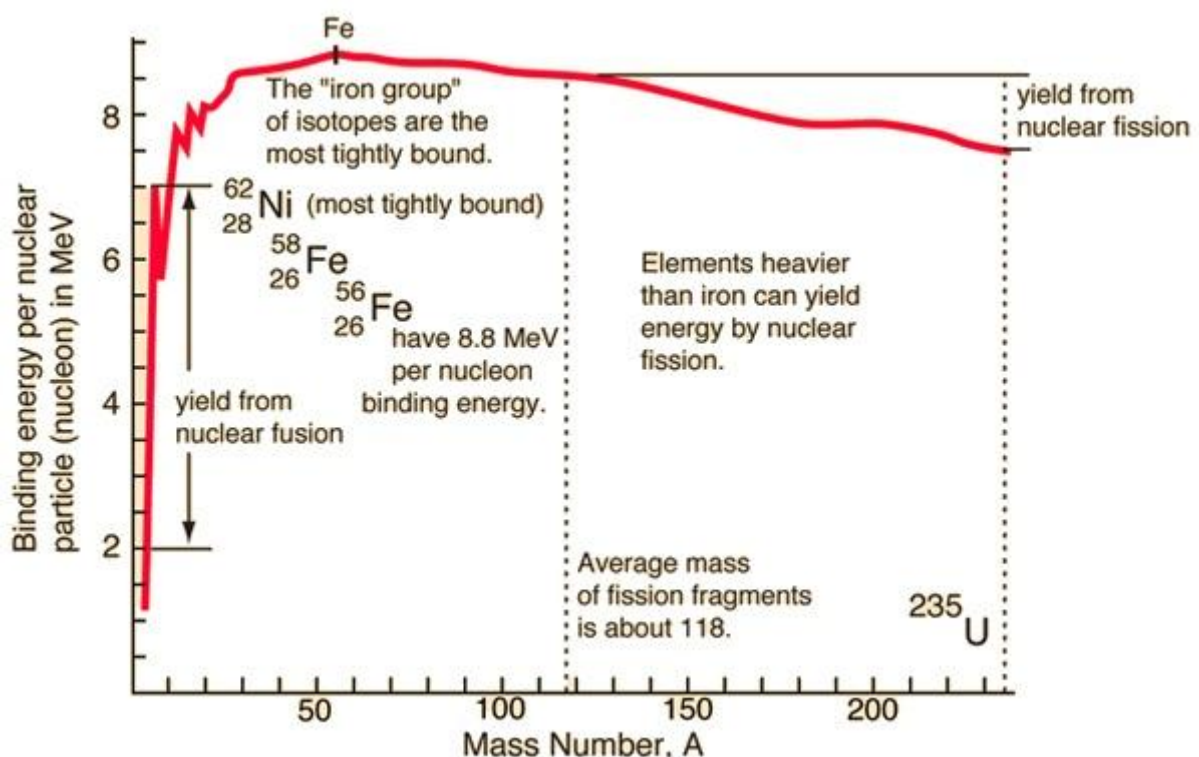


The plasma reactions taking place inside these tremendously strong electromagnetic field will be different than just plain Hydrogen\Helium phase transition recombination taking place on the rest of the surface area. The extreme forces applied in those electromagnetic fields on plasma will cause fusion reactions to take place creating elements like Iron, oxygen, silicon, magnesium etc and releasing energy in the process. The mechanics of these fusion reactions are well under stood and the forces prevailing inside rotating plasma fields are of the order of the nuclear binding energies¹ required to fuse the H/He nuclei's to form these elements nuclei's. Temperatures of the order of ~10MKelvin have been observed around those electromagnetic fields on the sun and it is likely that they are much higher in the inner Z-pinch zones where the fusion reactions are taking place.

The electromagnetic Z-pinch (Lorenz Forces) acting in the centre of the rotating plasma fields acting on a particle of charge q moving with velocity \mathbf{v} in the presence of an electric field \mathbf{E} and a magnetic field \mathbf{B} , will be

$$\mathbf{F} = q[\mathbf{E} + (\mathbf{v} \times \mathbf{B})]$$

The nuclear binding energy curve below shows elements heavier than Iron requiring energy to bind them instead of releasing energy. [Heavier elements like Uranium will release energy (nuclear fission) when their atoms are split up, so they require energy instead of releasing it to bind them in fusion to create those atoms].



Binding energy Curve

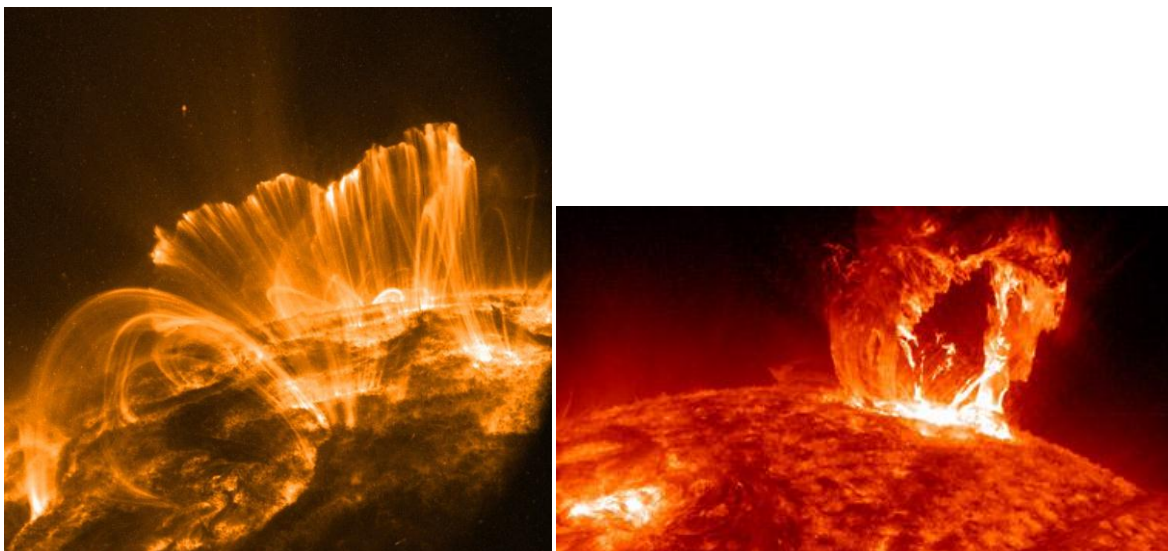
This is the reason that we see composition of older stars and cooled stars (planets) consisting mainly of Iron, oxygen, silicon, magnesium, nickel, sulphur and small amounts of other elements. Lighter elements like hydrogen, Helium and Carbon even though present in abundance initially in gas phases will escape into the space (In the form of H, He and Methane gas) as the star cools leaving little amounts of these elements left mostly combined with other elements on the cooling planet.

The fusion reactions taking place inside Z-pinch zones of fast rotating plasma fields fusing Hydrogen nuclei and to form Helium and other

heavier nuclei and releasing energy is the process that power the sun and other stars. These rotating plasma fields will be like fast moving fusion reactors continuously generating energy and powering the sun for millions of years to come at a nearly steady rate. These plasma fields are a function of the processes of the atmosphere of sun and will continue to form, evolve, move, merge, combine, interact with other fields, dissipate and regenerate on a continuous basis much like a weather system.

The heat produced in these fusion reactions will be absorbed by the plasma almost evenly across the sun due to extreme turbulence (Magneto hydrodynamics MHD – causing stirring of plasma) inside its core and will keep it stable by supplying this energy to plasma causing its appearance to be of uniform luminosity for many millions of years until the fusion reactions slow down and stop.

Once all the ionised material has recombined to form the elements the star will no longer shine and it will start its long cooling process to become a solid planet² many billions of years later as per Stellar Metamorphosis theory³. This last phase of plasma recombination won't be like switching off a light bulb but a gradual one i.e. as the plasma material decreases the star start dimming in luminosity and goes on dimming until it no longer shines.



We observe many arcs of material extending from one magnetic field to the other on the surface of the sun, if we study the composition of the material emanating from these arcs and compare it against the rest of

plasma, might give us strong evidence of fusion reactions in those locations. The arcs emanating are coming out of electromagnetic fields so have been subjected to fusion reactions in centre of these fields by Z-pinch (Lorenz forces) and spectral analysis of those arcs might give us vital information of that process. The increase of temperatures (increased luminosity) around the ejection locations of those arcs is indicative of exothermic energy being generated around those areas. The size\strength of the electromagnetic fields will determine what elements gets synthesised in a particular spot as different elements have different nuclear binding energies for their respective nuclei's and each element will get synthesised in a particular set of conditions only. Most of the elements synthesised by this process will form the core of the cooling star and will emerge as a solid planet many billions of years later as it cools down and all the gases around it dissipates to a thin atmosphere(All stars cool down and become planets – Stellar Metamorphosis).

This new hypothesis of nuclear fusion on the surface of the sun resolves the problem of coronal heating which cannot be explained using conventional model of fusion (with fusion inside the core of sun). With this new model of fusion all the heat is generated on the surface and this heat is dispersed in the corona by the arcs emanating from the fusion zones. Many of these arcs form magnetic connections forming coronal loops flowing with super-hot plasma coming out of fusion zones of electromagnetic fields whereas at other times the ejections rise and fall back under gravity. This super-hot plasma gets shot out at incredible speeds from the surface into the corona and it falls back under sun's gravity at much slower speeds, and it is cooling down all this time. So it would explain why the hottest parts of corona are observed at higher levels as that is the location where compressed plasma ejections from electromagnetic fields spends most time at hottest temperatures before they fall back down colder. This process will explain how the energy is transported up to the corona and mechanism responsible for the transport thereby solving the mystery of coronal heating.

This hypothesis also explains how the hot plasma gets squeezed out through the Z-pinch magnetic fields after fusion and gets ejected out at very high velocities as compressed coronal plasma (In the direction of the

magnetic fields) and forms coronal loops with opposite polarity magnetic fields at other locations reaching coronal altitudes of up to 1 mill Km high. Coronal loop structures can therefore be easily explained and understood using this model of fusion on the surface reactors of the sun.

The powerful solar flares can also be explained using this theory, when two electromagnetic fields of opposite polarities interact with each other inside the core from opposite sides of the surface of sun they will greatly magnify the power of the ejection pulse with that interaction.

This theory will also explain the coronal holes in the polar regions of the sun by linking its observed electromagnetism to its weather systems. The fast and slow solar winds can also be explained using this theory, slow being caused by ejecta of plasma recombination processes whereas fast solar winds caused by electromagnetic ejections from the corona loops. This theory can be applied to give a direct rational explanation of many other phenomenon of the sun without resorting to any vague assumptions.

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