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Solar Explanation Through Magnetohydrodynamic Modeling Advancement

Magnetic is magneto, one of the states of matters is hydro, and progress is dynamic. With that, magnetohydrodynamics is the subject of “fluids”. These fluids conduct electricity and its magnetic components. The fundamental concept is that the magnetic fields can induce currents in. Consequently, this polarizes plasma, salt water, or liquid metals. These factors change the magnetic fields itself. Difficultly, the approach for any research is to prove the intended research. Here, it is to prove if it fits a hypothesis of the magnetic interactions that the solar plasma emits. Nevertheless, nothing is completely proven. Additively, with three decades in their research, there were five cases focused upon. Since the Nobel-Prize winning discovery of magnetohydrodynamics in the sixties, it is unoriginal. Problematically, the kinematics have had a deficiency in updates to rapid calculation. Noting these, the cases differentiate based on advancements and technique variations in modeling. After all, what these studies asked are the observation of the plasma in the Sun will produce as a model. In turn, this will answer where in the corona the location of the energy to heat the plasma. That is where the dissipation of magnetic currents could root out more answers. Mostly, time will tell of the evolution in modeling. It tells if it will attest the magnetic interactions in solar flares. Therefore, will we be aware that the solar corona is magnetically live and well?

When it came to addressing magnetohydrodynamics, one of the earliest experiments with fluids was done by the father of the electric field himself: Michael Faraday. Formulaically, this experiment was on the salt water. There was a focus on its potential difference from its interaction with the Earth’s magnetic field. Eventually, the Max-Planck-Institut discovered that the examined coronal loops heated. Predominantly, Ohmic heating heated these loops. The braiding of field lines through the photospheric motions induced Ohmic heating. Additively, the NASA Astrophysics Data System focused on the magnetic loops' footprints in the corona. This determines the speed of the downflow from its expanding loops. Contrarily, the Swedish Institute of Space Physics placed attention on the interactions between the solar wind ejections upon solar system objects. In addition, Stanford studied the gasdynamic models of this planet's magnetosheath. Lately, the contemporary case has been the data-driven modeling magnetohydrodynamic modeling. The SIGMA Weather Group from the Chinese Academy of Sciences provided this study.

Previously, each magnetohydrodynamic solution was time-consuming using a Cray YMP computer. Stanford's and the American Astronomical Society's study acknowledges the difficulty of computation. Problematically, this is due to the enormous number of values that must be output to represent a single solution. Critically, Flash Code is a difficult software. It utilizes modules that mesh hydrodynamic code to model astrophysical thermonuclear flashes. The Stanford paper elevated the comprehensions of the solar active region and its magnetic loops. By the details of free energy, focus drifted off of the Flash Code towards the bow shock trends of the models from the Swedish research team. Advancing, that is where the SIGMA study addresses the data. The National Supercomputer Center in Tianjin, China carried out the computational work. Their simulation started with a magnetohydrodynamic model that is almost current-free. Then, they focused on the photospheric field in a low plasma condition. Precisely, the HMI of the supercomputer provided routine vector data of the photosphere. This had a resolution of one arc second for any formations of solar eruptions. By supplying the bottom boundary derived from the Poynting flux, the data was driven. Descriptively, the Poynting is the directional energy flux of an electromagnetic field. Conclusively, the models exemplified that the magnetic free energy continuously increase due to the uninterrupted injection of energy into the volume with graphic models that free energy is proportional to time. This fits the topographic models of evolution in the magnetic field of the coronal as it loops.

Overall, there was an agreement for the delivery of sufficient amount of energy at the base of the corona to heat the plasma. The magnetic flow of the Sun bases this agreement, expelling solar flares. Regardless, these studies have increased sophistication since the idealized models. What intrigued me is the scale of the polytropic model that requires the interaction of forces by plasma, magnets, and solar gravity. What this adds in the German study is a self-consistent description of the thermal structure of the plasma. Also, it added the magnetic field in the coronal structure. All the model had to do was include heat conduction by gravitational force. Specialized, the Swedes studied the interaction of solar winds to solar system objects. This Flash Code method scaled magnetohydrodynamic aspects on a smaller scale. Overall, this is fundamental to classify plasma. Additively, Stanford shapes the work of the Swedes on the interaction between the solar wind and solar system objects. Stanford did so by focusing on the terrestrial magnetosheath rather than comets. Contrarily, SIGMA’s latest observation builds from the other three studies. There is the new emphasis on the modeling of solar eruptions. Fundamentally, these studies build on the curiosity of location for the energy of the corona to heat the plasma. Also, its effects on the solar system objects. Stanford addressed magnetohydrodynamic components through gasdynamics. Gasdynamics is the compressible flow or the branch of fluid mechanics. This deals with flows having significant changes in fluid density. Topically, it shares elements of how the corona is live and shifts its magnetic field as its plasma. Conclusively, the newly ionized neutral atmospheric molecules influenced Venus' magnetosheath. It modeled bow shocks where the plasma properties from solar flares change from one equilibrium to another. Illustratively, this study is unique for the attention on shock waves and connection of the bow shocks from observing terrestrial planets to the amount of sunspots. Effectively, the sunspots' magnitude is proportional to the intensity of solar flares. Interestingly, they degenerate the magnetosheath of the Moon or any objects like it that they neither have a magnetic field. There is nothing to stop the solar wind plasma before it reaches the surface.

Fascinatingly, the modeling was utilized to elevate beyond observations. Focusing on the German study, three-dimensional model is not enough to resolve the dissipation length scales done with precision. But, it provides the redistribution of energy. What was learnt is that it is unnecessary to obscure sunspots. Though, utilizing x-ray imaging from telescopes, connection of two extended regions showing opposite polarity notices the hot loops. Therefore, there is a strong magnetic field in the Sun. This objective placed the concentration of three-dimensional modeling to the topic of solar magnetohydrodynamics. It shifted far from 1992 American Astronomical Society's study by non-linear 2.5D simulation. This model was the inclusion of three-dimensional vector components without its variation. Also, it advanced beyond kinematic-oriented work done by 1998's study in California on coronal holes. Captivatingly and definitively, SIGMA's modeling methods were numerical calculations of time-dependent kinematics with the bottom boundary conditions. The boundary conditions were proportional to the photosphere's observations. Sparingly, the researchers did not consider the physics of the chromosphere to the transition region. Quantumly, this is due to the unknown of how the coronal heating mechanized itself. This is where temperatures soar from a few to several magnitudes of degrees. Significantly, SIGMA coloured the magnetic loops of previous studies. By graphing the free energy from the solar plasma, SIGMA traces the German study. They observed the active regions of sunspots and its redistribution of energy. Reevaluating the 2013 study, they would define magnetohydrodynamic components in their models by its projections of field lines crossing the maximum of the synthesized emission of the respective loop in the three-dimensional computational domain. For Stanford's then innovative gasdynamic convected magnetic field model, a workstation derived a tractable approximation to the magnetohydrodynamic model. The corresponding magnetohydrodynamic solutions as well as the Earthly and other solar system's observation demonstrate its accuracy. Just compare it with the solar wind data. If the field aligned with the flow, the magnetohydrodynamic equations can transform into a simpler set of equations. These equations would resemble those of gasdynamic. Mathematically, it adds to the phenomenon portrayed by the Swedish study. It integrated the characteristic weak bow shock in all simulations. From the stand-point of bow shocks when observing these models again, the phenomenon of magnetohydrodynamics is based on the drape of the magnetic field from the nucleus of the observed solar system object as the solar wind impacts it.

In conclusion, the fundamental concept behind this study is that the magnetic fields can induce currents in. Consequently, this polarizes plasma, salt water, or liquid metals. In turn, this changes the magnetic fields itself. With the processes of modeling, there is an identification of the global magnetic structure of the Sun. Predictively, the future corona studies would reproduce the magnetic connections if this magnetosphere still loops. The models' field lines garnered this. This would be mentally ingrained when the phenomenon of magnetohydrodynamics comes to mind. Personally, it builds on the impact that computational modeling has advanced far. Earlier, it started from the studies of the solar atmospheric magnetic flux. Later, studies from supercomputers would factor out the entirety of the chromosphere. Phenomenally, the study and models of magnetohydrodynamic will continue to do so. Before computation, many scientists believed that there was a magnetic connection. A magnetic connection was in the solar flare as it pummels our world. This was once done by observing the Sun. Currently, we can see to believe by believing in supercomputer calculations and its computer models.

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