[초SS-01] Particle Energization in the Solar Corona and Solar Wind

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The coronal heating problem and solar wind acceleration problem are two inter-related outstanding problem. It is one of the unsolved problems in space and astrophysics. It is commonly believed that coronal heating and solar wind acceleration are intimately related to charged particle energization that stems from interaction with Alfven waves that are pervasively generated on the surface of the Sun. However, Alfven waves cannot directly interact with the particles because their wavelength is too long and the frequency too low. Alfven waves must first undergo turbulent cascade to shorter wavelength and/or higher frequency modes until they reach the kinetic dissipation range, at which point, the waves are absorbed by the particles via resonant wave-particle interaction. This resonant interaction is at the origin of the charged particle energization, but it is poorly understood. The reason is because there is no satisfactory kinetic theory of plasma turbulence applicable to Alfven wave cascade. The present tutorial will overview outstanding issues and latest attempts toward a comprehensive theory of particle energization in the solar corona and solar wind.

[구SS-02] Inverse Cascade Type Growth of Coronal Magnetic Systems

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This paper presents a numerical simulation study on how small scale flux tubes merge and form a grand scale flux rope as observed in solar eruptions. Magnetic field structures in and below the solar surface are like islands in the ocean of plasma. When the magnetic flux tubes emerge into the corona, plasmas can no more segregate them from each other. Originally separated magnetic structures come into contact and naturally create current sheets between them. Although magnetic reconnection tends to smear out the current sheets, partitional structures cartitibe totally destroyed all at once because of the huge Lundquist number of the coronal plasma and strong line-tying conditions. Magnetic field structures rather incrementally grow by merging of smaller scale structures. The growth of magnetic flux systems is viewed as a self-organizing process with an inverse cascade. An explanation is inferred for why the incremental growth of a magnetic flux system often leads to a grand scale solar eruption.