# Group movement by magnetic coupling of high-speed protons running side by side in the chromosphere of the Sun

*Shinji Karasawa[1]

1. Miyagi National College of Technology Professor emeritus

There are a lot of spicules in the chromosphere at the surface of the Sun. The proton ($H^+$) rises at high speed from the bottom of the chromosphere to the top increasing the speed by the magnetic effect. When $H^+$ reaches the corona region, the mean free path becomes longer and does not occur the ionization. In the surface layer of the Sun, the movement of electrons is changed by the motion of $H^+$, but the movement of $H^+$ does not change by electromagnetic waves and the momentum of electrons.
The magnetic field that moves with $H^+$ generates an electric field vertically, and electrons accompany with the field. The high-speed $H^+$ that runs side by side is magnetically coupled, and the electron rarely re-combine with $H^+$ by the repulsive magnetic force. The distance $d_{eq}$ that brings the force of magnetic equal to the force of the coulomb is obtained by using the relationship $\mu_0(qv)^2/(2\pi d_{eq}) = (q)^2/(d_{eq})^2$. In case that the speed of $H^+$ is 100km/sec, $d_{eq}$ is 0.5 mm.
There is a cusp structure at the top of the plasma loop. There is an Electromagnetic Fluid Dynamic theory that the soft X-rays are generated by magnetic reconnection. However, when $H^+$ is bundled together by magnetic effects, a cross point becomes a cusp structure and it releases soft X-rays. When the subsequent plasma develops larger than the preceding plasma, it becomes faster and flare is generated.
The momentum of $H^+$ groups causes the superrotation of west side wider on the mid-day hemisphere on Venus by accelerating the west side and slowing down the east side. The solar wind has significant effects on the solar system [1].
[1] S. Karasawa, " Effects of high-speed protons of solar wind on the ionosphere of the Earth", Technical Report, IEICE Vol. 119, No. 203, AP2019-70, pp. 1-6.
http://www7b.biglobe.ne.jp/~shinji-k/Eg2019IEICE%20A-P.pdf

Keywords: Chromosphere, Corona, Spicule, Flare, Cusp Structure, Electromagnetic Fluid Dynamics

 