Study on the Energy Source of Small-Scale Ulf Waves in the Magnetosphere

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Abstract – It is assumed to date that the energy source of azimuthal small-scale ULF waves in the magnetosphere (azimuthal wave numbers m1) is provided by the energetic particles interacting with the waves through the bounce-drift resonance. In this paper we have solved the problem of the bounce-drift instability influence on the spatio-temporal structure of Alfven waves excited by a source of the type of ´ sudden impulse in a dipole-like magnetosphere. It is shown that the impulse-generated Alfven oscillation within a time ´ τ~m/T N (where T N is the toroidal eigenfrequency) is a poloidal one, and each field line oscillates with its own eigenfrequency that coincides with the poloidal frequency of a given L-shell. As time elapses, the wave becomes toroidally polarized because of the phase difference of the disturbance, and the oscillation frequency of field lines tends to the toroidal frequency.

Keywords – Magnetosphere, Energy Source, Azimuthal etc.

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INTRODUCTION

The presence of the life on Earth is an endowment of the Sun. It is a genuinely normal star of the ghostly kind G2V, which is exceptionally near the Earth. In this way, it gives warmth and light to us that are vital for the endurance of living animals. The Sun is the main star which can be concentrated in extraordinary subtleties because of its proximity to the Earth. In this way, the investigation of the Sun has focal significance in Astronomy and Astrophysics to comprehend the conduct of other Sun-like stars just as astrophysical plasma. The Sun is being concentrated from the antiquated occasions, in this manner, all the essential physical properties (e.g., mass, sweep, age, and so on.) are very entrenched with the more prominent precision.

Solar Interior

We cannot see the inside of the Sun, which is the area underneath the lowermost layer of the sunlight-based climate, i.e., the photograph circle, because of its bigger murkiness. Sun oriented helioseismology, which is the investigation of waves and oscillations at the sun powered surface (i.e.,

Table 1.1 The table presents the fundamental physical properties of the Sun. All the standard estimations of these parameters are received from Priest (1982). photosphere), is the main intend to consider the inside of the Sun. Center, radiative zone

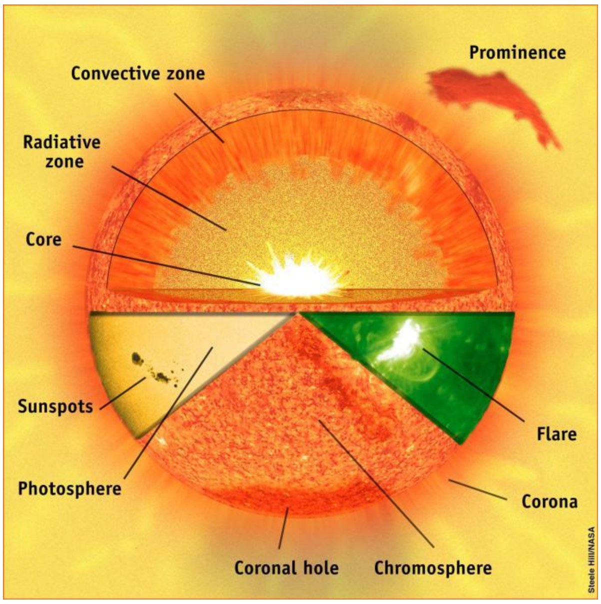

Figure 1.1 This schematic shows the different layers of the sun based inside just as external sun-based environment. (Picture Courtesy: SoHO/NASA) and convection zone are the three layers of the inside from focal point of the Sun (see, Figure 1.1).

The center, which is the focal piece of the Sun, is where huge measure of vitality is consistently being freed through atomic combination. In the atomic combination process, most bounteous component hydrogen changes into helium with a mass difference that discharged as vitality to control the entire Sun. Center's volume is just 1/15 of the entire volume of the Sun. In any case, center contains half of the mass of the Sun. The freed vitality, which is an extreme vitality wellspring of the Sun, spreads towards the sunlight-based surface through radiative and convection zones. Radiation that happens in the radiative zone, and convection that happens in convection zone, are two different physical procedures for the vitality transport from center to external layers. The vitality moves gradually through the denser radiative zone because of assimilation and re-emanation procedure of the photons, along these lines, it takes long time (105 years) to reach up to the base of convection zone.

The enormous measure of radiation is getting caught up in the cool hazy material at the base of convection zone, which warms the plasma there. This warmed material ascents towards the highest point of the convection zone in type of plasma masses. These plasma masses emanate vitality into the sunlight-based photosphere at the highest point of convection zone and sink down to become warmed and rise once more. These movements of the plasma masses make a constantly changing granular example at the highest point of convection zone. This top of convection zone is the interface locale between the inside and climate of the Sun. Thusly, top of the convection zone is the base of least and denser layer of the external sunlight-based air known as photosphere. This meager layer (~ 500 km) of the sunlight-based environment is the wellspring of unmistakable light.

Solar Atmosphere

The sun powered air is the association of different layers beginning from the low-est photosphere layer followed by chromosphere, change district and crown. This layer grouping of the sunlight based air depends on the nearness of different physical properties (e.g., temperature, thickness, and so on.) and their variety with stature. At first, temperature diminishes yet after a specific least temperature in photosphere layer it increments further towards the chromosphere, change locale and crown. Past the temperature least point, the temperature rises that prompts the arrangement of chromospheres pleatu, however after a specific tallness the temperature increments quickly (i.e., progress area) in the sunlight based climate. At last, the temperature profile turns out to be level in the crown in the wake of coming to million degree Kelvin (see, strong line; Figure 1.2). The thickness exponentially falls in the sun based climate from photosphere up to the crown (see, ran line; Figure 1.2). Based on different temperatures, the specificion

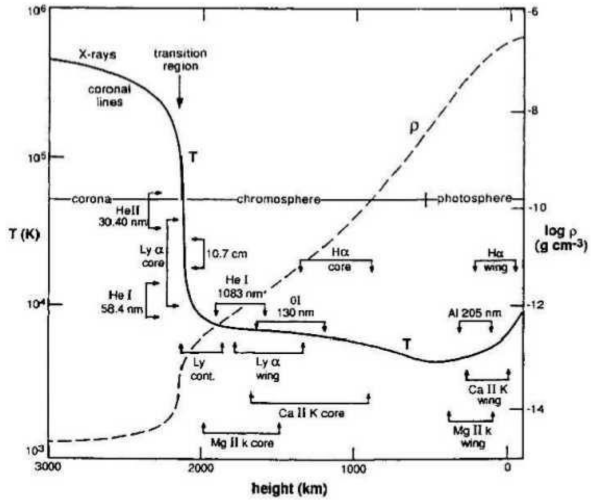

Figure 1.2 Variety of the temperature and thickness in the sun powered environment with tallness. Some predominant particles and their ghostly emanation are likewise appeared in each layer of the sun-oriented air.

Species rule in the specific layer (see, Figure 1.2), which are critical to see that specific layer of the sunlight-based air because of their outflows (UV, X-beam, radio, and so on.) at different frequencies.

The least barometrical layer (photosphere) is the denser, splendid and thin (i.e., ~500 km) layer with its effective temperature of ~ 5800 K. In spite of the fact that, the photosphere is denser piece of the sun-based climate, in any case, the weight is just a single ten-thousand (0.0001) of Earth's barometrical weight adrift level. The photosphere is typically refered as the sunlight-based surface yet it isn't the strong surface like Earth's surface, in any case, it is a slim vaporous layer of limited profundity of ~ 500 km. As indicated by the physical structure, the sun-oriented photosphere can be seen in white light, G band, Hα wings, Ca II K wings, and so forth (see, Figure 1.2 and 1.3). Granules, sunspots (see, Figure 1.3), pores, dynamic locales, and so forth, are all around watched attractive highlights of the sun-based photosphere, hence, the pho-to sphere comprises of different complex attractive highlights where colorful plasma forms happen.

Chromosphere, simply over the photosphere, is generally meager layer, in any case, this layer is similarly enormous in contrast with the photosphere. The temperature ascends from 5800 K to 20,000 K right now the gas thickness drops to about a million times not as much as that of photosphere. In the good 'ol days, chromosphere was watched uniquely during the all-out sun based shroud for a couple of moments when the obscuration totality, how-ever, presently sun powered chromosphere can be seen whenever in a few unearthly lines (e.g., Hα 6563 ˚A, Ca II K center, He I; Figure 1.2) with the assistance of room and ground based perceptions. The idea of the chromosphere is extremely perplexing because of the nearness of different intriguing plasma and wave elements in its organized and complex attractive fields.

The progress area, which is an interface locale between a lot cooler chromo-

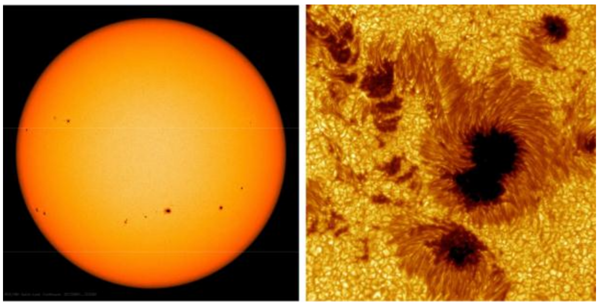

Figure 1.3 Left board: This picture speaks to the photosphere with barely any sunspot bunches on first August 2012. Right Panel:

This picture shows the zoomed perspective on the sunspot gathering, which was situated close to plate focus. (Picture Courtesy: SDO/HMI/NASA and Swedish 1-m Solar Telescope; Royal Swedish Academy of Sciences) circle and hot crown, is an unpredictable layer of around scarcely any hundred kilometers thick. Right now, the temperature rises suddenly from 20,000 K at top of the chromospheres to 106 K at the base of crown. This layer is considered as an irregularity among chromosphere and crown. The temperature rises suddenly while thickness falls quickly inside this layer, hence, it is named as change district (TR). The progress area can be seen in Extreme Ultra Violet (EUV) ghastly lines (e.g., He I 584 ˚A, He **II** 304 ˚A, O V, Lyα, and so forth.) as it for the most part discharges in EUV locale of the electromagnetic range. The fast difference in temperature might be a key to tackle the coronal warming issue, despite the fact that, it is as yet not surely knew that why this quick temperature change happens in the progress locale.

Sun powered crown, the peripheral layer of million-degree Kelvin plasma, reaches out up to a few million kilometers from the base of the progress locale. Despite the fact that, the upper limit of the sun-oriented crown isn't all around characterized. Regardless of high tempera-

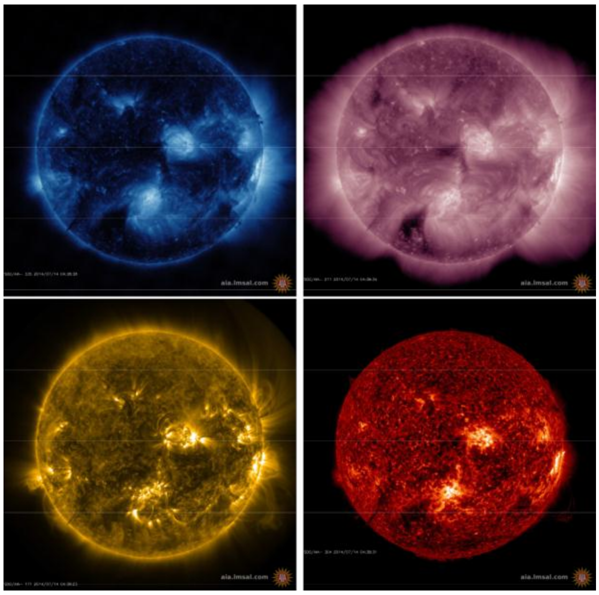

Figure 1.4 These four full-plate pictures of the Sun speak to the different locale of the solar air. The 335 ˚A (upper left; high temperature), 211 ˚A (upper right; high temperature dynamic locale crown), 171 ˚A (base left; calm Sun, dynamic district, and coronal gap) and 304 ˚A (base right; upper chromosphere and progress area). (Picture Courtesy: SDO/AIA/NASA) ture, solar crown isn't obvious straightforwardly against the brilliant foundation of photosphere because of its extremely low thickness, thusly, the crown can be seen during the solar shroud or through coronagraph.

SOLAR TRANSIENTS

The different exercises, which are the aftereffect of coupled elements of plasma and magnetic field in the solar environment, are all things considered called as solar transients. The investigation of the drivers, physical nature, and the role of different transients occurring at assorted spatio-temporal scales in the solar environment is at the fore-front of solar research. The comprehension of these transients is extremely critical to uncover the elements and warmth ing of the solar climate. Kept plasma discharges (e.g., spicules, macro spicule s, twirls and tornadoes, floods, X-beam planes, UV and EUV planes, and so for.) and enormous scope eruptive/transient procedures (e.g., solar flares, anemone planes, coronal mass launches, eruptive prominences, consistent solar breeze, and so forth.) are the two general classifications of solar transient**s.**

Macro spicule

Macro spicule s, generally known as monster spicules, are the plasma ejecta from chromospheres to upper corona. These structures have stream like appearance like the spicules, in any case, they happen on bigger spatio-temporal scales in contrast with the typ-ical chromospheres spicules. Bohlin et al. (1975) have found the macro spicule s in the solar air utilizing SKYLAB He II 304 ˚A perceptions. These structures can reach out between 7000-45000 km over the appendage and the width can shift from 5 arcsec to 15 arcsec (1 arcsec = 725 km) inside their all out life-time from few moments to around 40 minutes At first, it was discovered that macro spicule s don't show discharge over the temperature of 3×105 K be that as it may, watched a macro spicule emission in Mg XI 625 ˚A line conformed to 1 MK. Aside from these EUV perceptions, the macro spicule s are obvious in Hα additionally, in this way, the macro spicule s are the multi-temperature structures. The macro spicule s are generally gathered in the po-lar coronal openings Based on attractive topology, spiked macro spicule having an upset Y-shape structure like the coronal X-beam planes and twofold stranded eruptive-circle macro spicule like the fiber ejection, are two unmistakable classes of the macrop-spicules Attractive reconnection drives the spiked macro spicule while the twofold stranded eruptive-circle macro spicule is driven by the lengthening and ejection of circles arranged along an unbiased line among positive and negative polarities. In other phrasing, based on Hα emanations, recommended that H-α and EUV macro spicule s are the two general classes of the macro spicule s. Utilizing numerical reenactment, Shibata (1982) has indicated that these two kinds of macro spicule s are the consequences of different physical procedures. They have demonstrated that stun tube streams and peak stun planes can compare to H-α and EUV macro spicule , individually, in spite of the fact that, it isn't clear till date that these two kinds of macro spicule s are a similar magneto-plasma structures or not.

1. Solar Wind

All the fundamental arrangement stars misfortune their mass because of the nearness of dynamical phenomena in their climate. If there should be an occurrence of the Sun, CMEs are the sporadic discharge of the plasma, while the solar breeze is the ceaseless outpourings of the ionized plasma into the interplanetary space spiriling along the enormous scope attractive field lines. The presence of these constant surges was anticipated and later the presence of the solar breeze was affirmed by space-based perceptions. Protons, electrons and substantial particles (little segment) are the principle constituents of the solar breeze. Two kinds of solar breeze exist in the solar climate: the quick solar breeze with less thickness and high speed (∼750 km s−1), and moderate solar breeze with high thickness and lower speed (∼400 km s−1). These charged particles can likewise aect the Earth's external environment, along these lines, the comprehension of this persistent progression of the charged particles is fundamental.

The coronal gaps are the source locales for the quick solar breeze (Krieger et al. 1973),

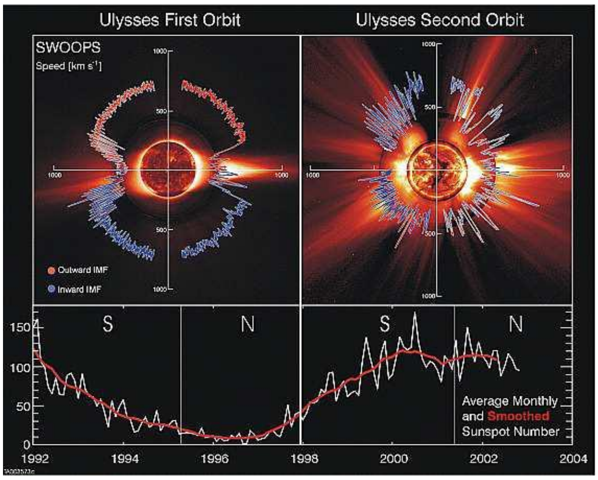

Figure 1.3 Upper board shows the conveyance of the speed of solar breeze with heliographic scopes, while the base board shows sunspot numbers (i.e., solar action level) with the time. First circle just as second circle outline the solar breeze structures during the solar least and solar greatest. Ulysses SWOOP information are superimposed on the composite picture got with SoHO/EIT, SoHO/LASCO C2 coronagraph and Mauna Loa K-Corona meter.

OBJECTIVE

1. To study investigation of these MHD waves (i.e., proliferation, scattering, driver, and so on.)

2. To study their potential role in coronal warming yet in addition in reasoning different properties of solar air utilizing guideline of MHD seismology

CONCLUSIONS

Point of the current proposition is to contribute in the better comprehension of the solar transients as far as their physical properties, driving instruments just as role of MHD wave/insecurities in these solar transients. In the current theory, I seek after certain investigations on the solar transients at various spatio-temporal scales which are centered around driving instruments, physical parameters and role in the solar climate of these solar transients. In this way, all crafted by proposition by and large add to propelling the current information about plasma/physical properties just as drivers of some solar transients at various spatio-temporal scales. So as to accomplish the previously mentioned objectives, we have utilized the space-based perceptions from different satellite which are dedicated to the solar perceptions

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