PEM29-P01 Room:Poster Time:April 30 18:15-19:30

Study of the slowly drifting narrowband structure in type-IV solar radio bursts observed by AMATERAS

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We show the type-IV burst event observed by AMATERAS on June 7, 2011, and reveal that the main component of the burst was emitted from the plasmoid eruption identified by the EUV images of SDO. The slowly drifting narrowband structure (SDNS) appear in the spectra of the burst. By a statistical analysis, we reveal that SDNS appeared with the duration of tens to hundreds of millisecond and with the typical bandwidth of 3 MHz. For the generation mechanism of SDNS, we propose the wave-wave coupling between Langmuir waves and whistler-mode chorus emissions generated in a post-flare loop, inferred from the similarities of the plasma environments between a post-flare loop and the equatorial region of the Earth's inner magnetosphere. We assume that a chorus element with a rising tone is generated at the loop-top of a post-flare loop. By referring to the propagation properties of chorus in the magnetosphere, we assume that the chorus element propagates downward along the magnetic field line and then propagates away from the central region of the flare-loop toward the outer edge of the loop where the plasma density is relatively small. By the magnetic field and plasma density models, we quantitatively estimate the expected duration of radio emissions generated through the coupling between Langmuir waves and chorus during its propagation in the post-flare loop and find that the observation properties of duration and bandwidth of SDNS are consistently explained by the proposed generation mechanism. The characteristics of SDNS are its intermittency in time and the negative frequency drift in the limited frequency band. While observation in the terrestrial magnetosphere shows that chorus is a group of large amplitude wave elements naturally generated intermittently, the mechanism proposed in the present study can explain both intermittency and slowly drifting narrowband structure in the observed spectra.

Keywords: solar radio burst, solar corona, wave-particle interaction

PEM29-P02 Room:Poster Time:April 30 18:15-19:30

Numerical simulation of magnetic field generation by relativistic effect in high intensity laser experiments

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It has been a big mystery how the seed (primordial) magnetic field is generated in the universe. In fluid description of plasma, a magnetic filed is coupled with a mechanical vorticity then represented as curl of canonical vorticity. Recently, Mahajan and Yoshida proposed a novel mechanism of vorticity generation by relativistic effect [1, 2]. The relativistic plasma have two vorticity generating terms, one is so-called baroclinic term(S_T). The baroclinic term is known to be weak except for strongly thermal nonequilibrium state (e.g. shock front). Mahajan and Yoshdia proposed that, even if the system is barotropic, there appears another term available to generate vorticity due to the relativistic effect (S_R).

Recent progress in high intensity laser experiment enables us to obtain relativistic electron plasma, and some of the workers established high accuracy measurement of the generated magnetic field [3]. The relativistic vorticity generation (RG) is expected to be verified in such high intensity laser experiments.

In this study, we conducted numerical simulation for the proposal of the experimental verification. We have following objectives; is RG sufficiently working in actual experiment? If not, in what parameters will RG effectively work? What is the characteristics of the magnetic field given by RG? We calculated for parameters relevant to the experiment in Ref. 3. Observing the ratio of relativistic baroclinicity to thermodynamic baroclinicity, we can state that thermal baroclinic effect is governing and RG is not sufficiently working. By raising the hot electron temperature or decreasing the ratio of skin depth to scale length, the ratio is improving (Fig).

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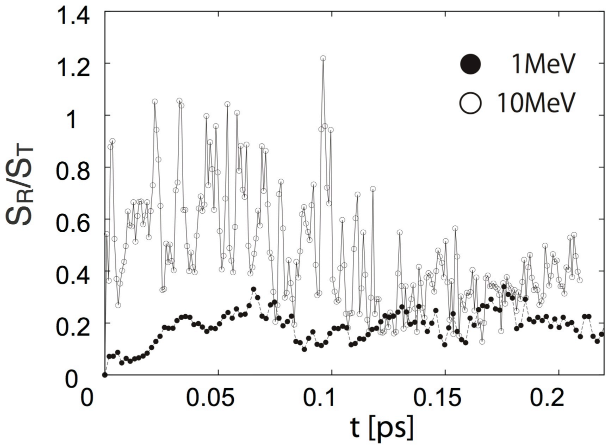
Keywords: relativistic plasma, high intensity laser experiment, magnetic field generation



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PEM29-P03 Room:Poster Time:April 30 18:15-19:30

The acceleration rate of cosmic rays in the cosmic ray modified shocks

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It is a still controversial matter whether the production efficiency of cosmic rays (CRs) is relatively efficient or inefficient (e.g. Helder et al. 2009; Hughes et al. 2000; Fukui 2013). In upstream region of SNR shocks (the interstellar medium), the energy density of CRs is comparable to a substantial fraction of that of the thermal plasma (e.g. Ferriere 2001). In such a situation, CRs can possibly exert a back-reaction to the shocks and modify the global shock structure. These shocks are called cosmic ray modified shocks (CRMSs). In CRMSs, as a result of the nonlinear feedback, there are almost always up to three steady-state solutions for given upstream parameters, which are characterized by CR production efficiencies (efficient, intermediate and inefficient branch).

We evaluate qualitatively the efficiency of the CR production in SNR shocks by considering the stability of CRMS, under the effects of i)magnetic fields and ii)injection, which play significant roles in efficiency of acceleration.

By adopting two-fluid model (Drury & Völk, 1981), we investigate the stability of CRMSs by means of time-dependent numerical simulations. As a result, we show explicitly the bi-stable feature of these multiple solutions, i.e., the efficient and inefficient branches are stable and the intermediate branch is unstable, and the intermediate branch transit to the inefficient one. This feature is independent of the effects of i) shock angles and ii) injection.

Furthermore, we investigate the evolution from a hydrodynamic shock to CRMS in a self-consistent manner. From the results, we suggest qualitatively that the CR production efficiency at SNR shocks may be the least efficient.

Keywords: shocks, particle acceleration, feedback from cosmic rays

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2D Full Particle-In-Cell Simulation on a High Beta Collisionless Shock and Particle Acceleration

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High beta and relatively low Mach number shocks are commonly present in a vriety of space and astrophysical environments, like the earth's bow shock, the heliospheric termination shock (effective beta is rather high due to the presense of pickup ions), galaxy cluster merger shocks, etc. Even such high beta shocks show some evidences that high energy particles are possibly accelerated there. Voyager 2 spacecraft revealed that the fluxes of non-thermal electrons and ions (the latter are called as termination shock particles) are enhanced at the crossings of the termination shock. Radio synchrotron emissions from relics of galaxy cluster mergers imply the presence of relativistic electrons accelerated in the merger shocks. In this study we perform two-dimensional full particle-in-cell simulation to discuss structure of the shock as well as the acceleration process of electrons. The one-dimensional simulations performed in the past showed that under the high beta and relatively low Mach number conditions the shock is more or less laminar and time stationary and electron acceleration occurs through the so-called shock drift mechanism. Here, we reveal that two-dimensional structure of the shock is highly complex even for such a high beta and a low Mach number and further that some electrons are accelerated to high energy but their acceleration mechanism appears not to be so simple as that reproduced in one-dimensional simulations.

Keywords: collisionless shock, numerical simulation, particle acceleration