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Energetic Particle Acceleration in the Inner Magnetosphere by ULF waves excited by interplanetary shock
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When an interplanetary shock or a solar wind dynamic pressure impulse impinges on the magnetophere, ultra low-frequency (ULF) waves can be excited in the magnetosphere and the solar wind energy can be transported from interplanetary space into the inner magnetosphere.

In this study, we have systematically studied ULF waves excited at in the magnetosphere by interplanetary shock or solar wind dynamic pressure impulse. We have found that the poloidal and toroidal waves excited by positive and negative pressure pulses oscillate in a similar manner of phase near 06:00 local time (MLT) and 18:00 M LT, but in antiphase near 12:00 M LT and 0:00 MLT. Furthermore, it is shown that excited ULF oscillations are in general stronger around local noon than those in the dawn and dusk flanks. It is demonstrated that the poloidal wave amplitudes are stronger than the toroidal wave amplitudes except in the magnetotail.

We have investigated the response of the Earths ring current ions including oxygen ions to ULF waves induced by interplanetary shocks. Both Earths ring current ions - hydrogen and oxygen ions are found to be accelerated significantly with their temperature enhanced by a factor of two and three immediately after the shock arrival respectively. Multiple energy dispersion signatures of ring current ions were found in the parallel and anti-parallel direction to the magnetic field immediately after the interplanetary shock impact. The energy dispersions in the anti-parallel direction preceded those in the parallel direction. Multiple dispersion signatures can be explained by the flux modulations of local plasmaspheric ions (rather than the ions from the Earths ionosphere) by ULF waves. It is found that both cold plasmaspheric plasma and hot thermal ions (10 eV to 40 keV) are accelerated and decelerated with the various phases of ULF wave electric field. We then demonstrate that ion acceleration due to the interplanetary shock compression on the Earths magnetic field is rather limited, whereas the major contribution to acceleration comes from the electric field carried by ULF waves via drift-bounce resonance for both the hydrogen and oxygen ions. The integrated hydrogen and oxygen ion flux with the poloidal mode ULF waves are highly coherent (>0.9) whereas the coherence with the toroidal mode ULF waves is negligible, implying that the poloidal mode ULF waves are much more efficient in accelerating hydrogen and oxygen ions in the inner magnetosphere than the toroidal mode ULF waves.

キーワード: Energetic particle, ULF waves, Inner magnetosphere, Acceleration, Wave-Particle Interaction
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