THE INFLUENCE OF ELECTRON TEMPERATURE ON COSMIC RAY INJECTION IN HIGH MACH NUMBER MAGNETOSONIC SHOCKS

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Electron pre–acceleration from thermal to mildly relativistic energies in high Mach number shocks (the injection problem) is an outstanding issue in understanding synchrotron radiation from supernova remnants. At high Alfvénic Mach numbers, collisionless perpendicular shocks reflect a fraction of the upstream ions. This gives rise to two–stream instabilities which in turn can accelerate ions, see eg Ref [1]. However in astrophysical plasmas the plasma β – the ratio of kinetic to magnetic pressure which specifies the effective electron temperature – is not well known. We have used a particle in cell simulation code to investigate the influence of β on the shock structure and on the electron acceleration. Previous simulations at low values of β [2] showed that the phase space distributions of electrons and ions became highly structured: characteristic holes appear in the electron phase space and the shock dynamics exhibit reformation processes. However, we find that all these features disappear at higher β due to the high initial thermal velocity of the electrons. It follows that the electron cosmic ray injection mechanism depends strongly on β, that is, the effective electron temperature upstream.

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[2] N. Shimada and M. Hoshino, Astrophys. J. **543**, L67 (2000)