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Particle acceleration and magnetic field generation in SNR shocks
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— We discuss the diffusive acceleration mechanism in SNR shocks in terms of its potential to accelerate CRs to 10^{18} eV, as observations imply. One possibility, currently discussed in the literature, is to resonantly generate a turbulent magnetic field via accelerated particles in excess of the background field. We analyze some problems of this scenario and suggest a different mechanism, which is based on the generation of Alfven waves at the gyroradius scale at the background field level, with a subsequent transfer to longer scales via interaction with strong acoustic turbulence in the shock precursor. The acoustic turbulence in turn, may be generated by Drury instability or by parametric instability of the Alfven (A) waves. The essential idea is an A→A+S decay instability process, where one of the interacting scatterers (i.e. the sound, or S-waves) are driven by the Drury instability process. This rapidly generates longer wavelength Alfven waves, which in turn resonate with high energy CRs thus binding them to the shock and enabling their further acceleration.

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