

Simulation study for the laboratory experiment of Bell's instability

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The diffusive shock acceleration at the forward shocks of shell-type supernova remnants is believed as a prime process to generate high energy cosmic ray particles. For efficient acceleration, Bell's instability, driven by streaming cosmic rays, is proposed as a candidate for providing the required magnetic turbulence in the upstream region of the shock [1]. This non-resonant and nearly purely growing electromagnetic instability had been investigated with MHD studies and Particle-In-Cell (PIC) simulations, it shows that the magnetic field fluctuations stronger than the background interstellar field is possible theoretically [1,2].

In order to examine the saturation level and mechanism of Bell's instability in the laboratory, we attempt to develop a laboratory experiment by using the plasma cell and electron source of the PITZ group of DESY. Before the actual experiment, here we would present the numerical investigations, based mainly on the fully kinetic PIC simulations, that study physical conditions for the Bell's instability to occur in our laboratory experiment and its expected properties.

References

- [1] A. R. Bell, *Mon. Not. R. Astron. Soc.* **353**, 550 (2004)
- [2] J. Niemiec *et al.*, *Astrophys. J.* **709**, 1148 (2010)