

Non-relativistic collisionless shocks in unmagnetized and weakly magnetized plasmas

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We would like to show the results of PIC simulations of non-relativistic collisionless shocks in unmagnetized and weakly magnetized electron-ion plasmas. In unmagnetized plasmas, it is shown that the so-called "Weibel-mediated shocks" can be formed even at non-relativistic shock speed ($\sim 0.1c$) (Ref. [1]) like the relativistic cases (e.g., Ref. [2]). On the other hand, in weakly magnetized plasmas, the current filaments similar to those in the unmagnetized (Weibel) shocks are generated within the shock transition layer, too, and they can affect the shock structure especially when the background magnetic field is as weak as, for example, that around the SNR shocks. It is also shown that the current filaments generate highly tangled strong magnetic field in the downstream region. Both kinds of collisionless shocks can be generated in laboratory plasmas with intense laser facilities.

References

- [1] Tsunehiko N. Kato, "Relativistic Collisionless Shocks in Unmagnetized Electron-Positron Plasmas", *Astrophysical Journal*, 668, 974--979, 2007
- [2] Tsunehiko N. Kato and Hideaki Takabe, "Nonrelativistic Collisionless Shocks in Unmagnetized Electron-Ion Plasmas", *Astrophysical Journal*, 681, L93--L96, 2008