We present how to simulate a plasma shock wave with pre-existing turbulence using particle-in-cell code.

**How?**
- generate – bulk velocity disturbance
- inject – matching method
- run – reflecting wall

**Turbulence**
- compressive
- long-lived (few ion Larmor times)
- represents high-Mach-number and low plasma beta regime

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**PIC simulations of SNR’s shock waves with a turbulent upstream medium**

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**Introduction**
Supernova remnants (SNR) are plausible candidates for sources of the Galactic Cosmic Rays. The particles gain energy via Diffusive Shock Acceleration (DSA, see Fig. 4), which requires that their Larmor radii must be comparable to the shock width. Thermal electrons do not satisfy this condition, hence some electron pre-acceleration mechanism has to operate.

**Motivations**
Previous SNR’s shock simulations assumed homogenous upstream medium (all the turbulence ahead the shock was driven by reflected particles), but space physics research indicates importance of pre-existing turbulence.

**Methods**
To capture electron scale physics we use a particle-in-cell code (PIC), which solves kinetic plasma equations. A slab of turbulent plasma is generated separately in a periodic box simulation, then it is injected into a shock simulation. State of the pre-fabricated plasma is different than state of the plasma from the simulation, so we need to match them.

**Results**
- A compressive turbulence plasma slab is generated via superposition of velocity waves.
- The pre-fabricated slabs are matched using cell-wise procedure – weights for magnetic and electric fields, and particles.
- In order to satisfy Maxwell’s equations after imposing weights the correction for \( \text{div} B \) and \( \text{div} E \) is needed.

**Conclusions**
Our framework allows to perform more realistic simulations of shock waves in various astrophysical environments.