



5<sup>th</sup> Asia-Pacific Conference on Plasma Physics, 26 Sept-1 Oct, 2021, Remote e-conference

## Magnetohydrodynamic-particle-in-cell method and its astrophysical applications

Xue-Ning Bai<sup>1</sup>

<sup>1</sup> Institute for Advanced Study and Department of Astronomy, Tsinghua University

e-mail: xbai@tsinghua.edu.cn

I will give an overview of the MHD-PIC method, which is developed to study the kinetic physics of cosmic-rays interacting with a background thermal plasma. It treats the cosmic-rays as particles using the conventional PIC approach, while treat background plasma as a fluid described by MHD. This method substantially alleviates the issue of scale separation encountered in conventional PIC approach, and enabled a wide range of plasma astrophysical applications. These include particle acceleration in shocks and reconnection, the microphysics of cosmic-ray transport and feedback, etc., which will all be briefly discussed.

### References

- Bai X.-N., Caprioli D., Sironi L., Spitkovsky A., 2015, ApJ, 809, 55  
Bai X.-N., Ostriker E.-C., Plotnikov I., Stone J.-M., 2019, ApJ, 876, 60  
Plotnikov I., Ostriker E.-C., Bai X.-N., 2021, ApJ, 914, 3  
Bambic C.-J., Bai X.-N., Ostriker E.-C., 2021, ApJ, in press (arXiv:2102.11877)

Figure xx

**Note: Abstract should be in (full) double-columned one page.**