

# Unraveling Plasma Acceleration in Low- $\beta$ Environments: Insights from MHD and PIC Simulations

Jasmin Deguire\*, Andrei Smolyakov

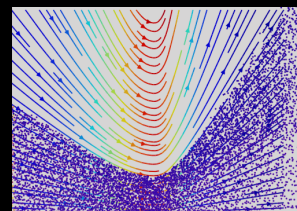
\* zjy417@usask.ca

Department of Physics and Engineering Physics,  
University of Saskatchewan

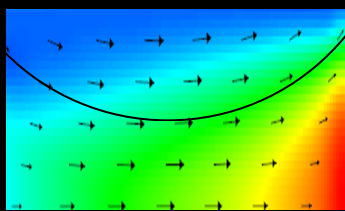
## Introduction

The magnetic nozzle derived from the Laval nozzle is used to accelerate plasma from subsonic to supersonic velocities. This kind of acceleration is observed in the solar wind dynamic.

## Methods

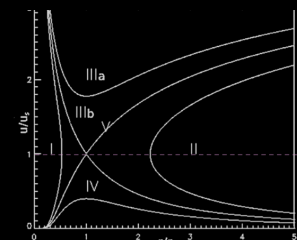


Particle-In-Cell

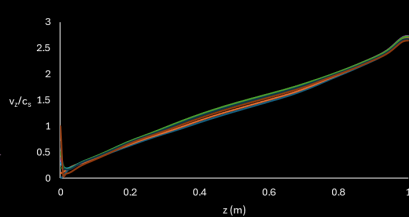


Magnetohydrodynamics code

## Results



Parker Solar winds [1]



Axial velocity for  $r=0$

## Discussion

The plasma may be accelerated by a gradient of pressure to supersonic velocity and by torsional Alfvén waves to superalfvénic velocities.

## References

[1] Krista, Larisza. (2012). The Evolution and Space Weather Effects of Solar Coronal Holes.

[2] Wójcik, et al. Numerical Simulations of Torsional Alfvén Waves in Axisymmetric Solar Magnetic Flux Tubes. Sol Phys 292, 31 (2017).

# Applying Solar Wind Acceleration to the Plasma in Magnetic Nozzles

