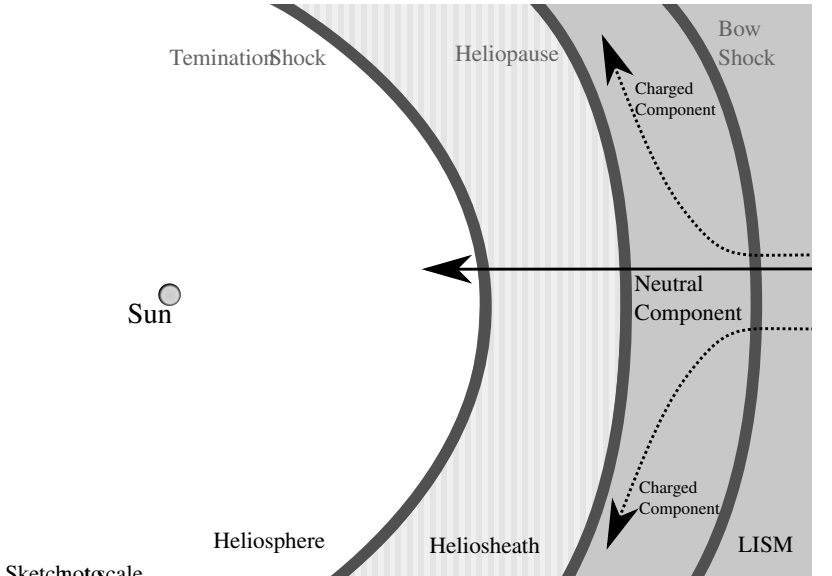
Kinetic simulations of PUI transport and pitchangle-scattering during turbulent conditions using PIC-Algorithms

Duncan Keilbach

mnf-phys-1311 (Fachliche Spezialisierung)

8. December 2016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Heliopause
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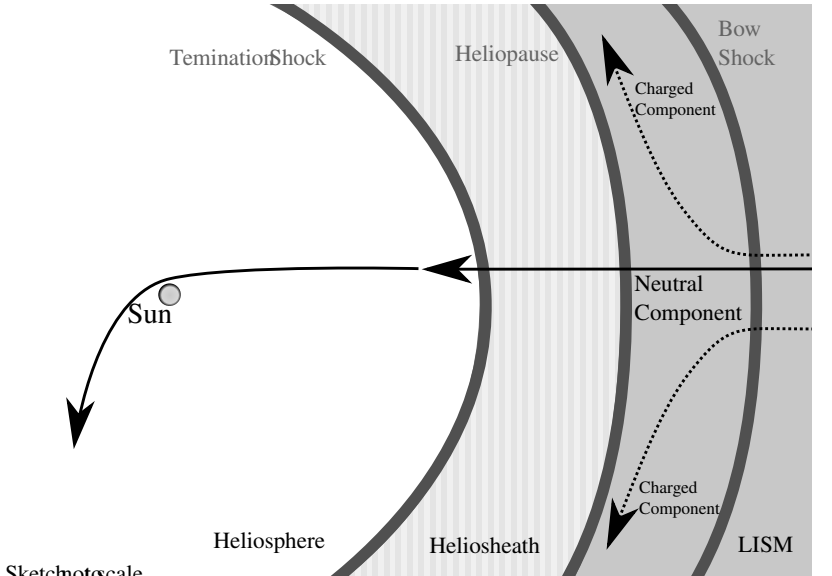
Charged
Component
Sun
Neutral
Component
Charged
Component
Heliosphere
Heliosheath
LISM
Sketch not to scale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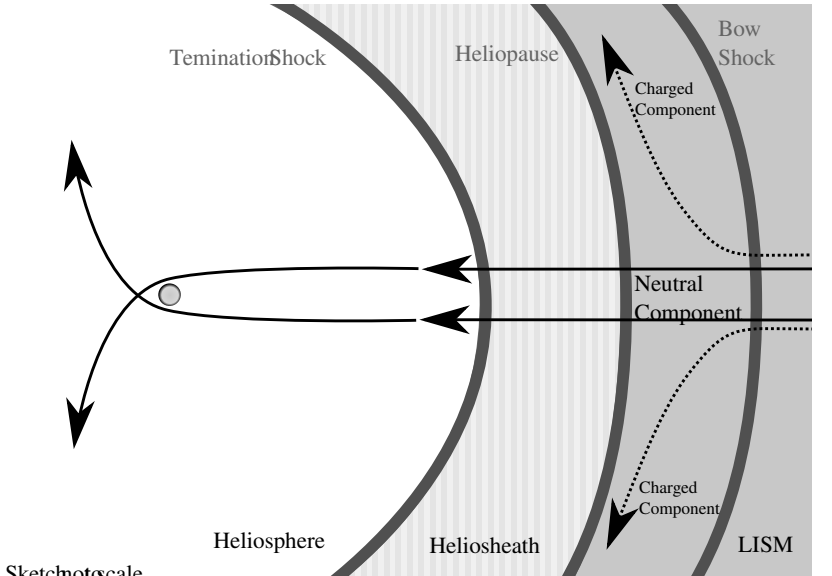
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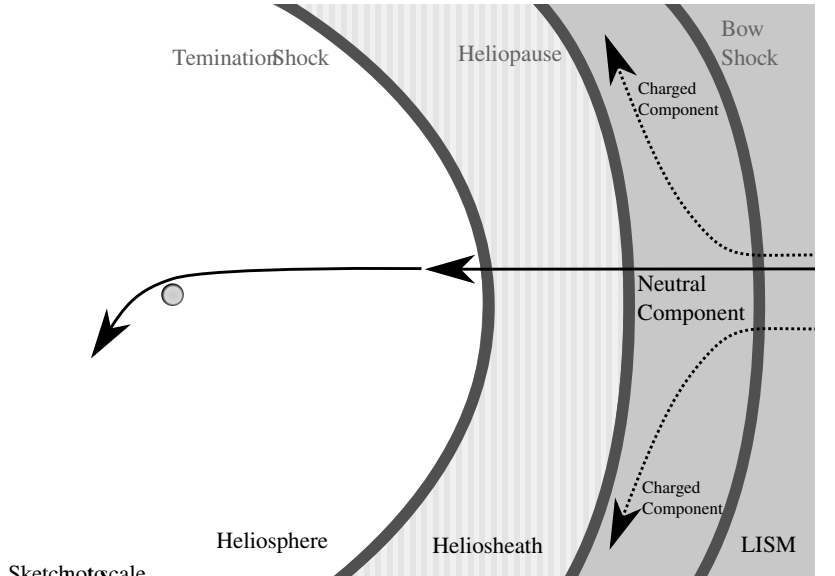
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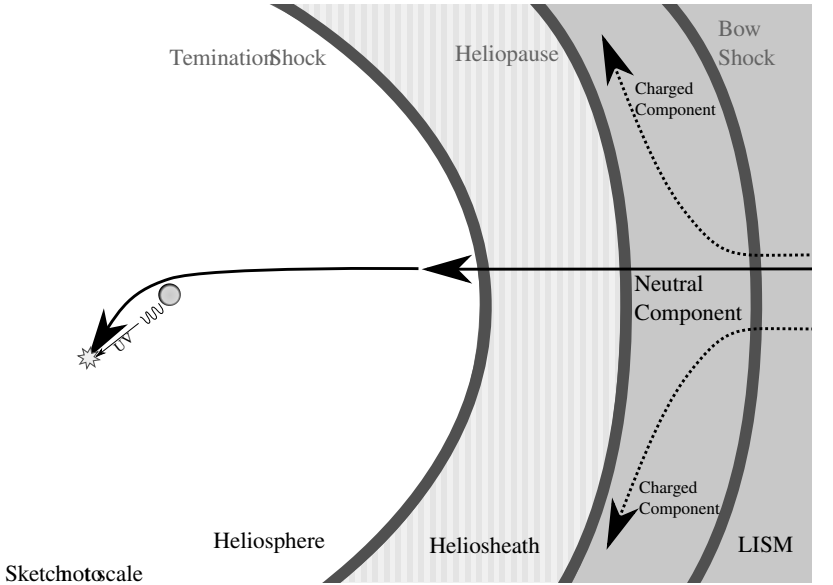
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Component
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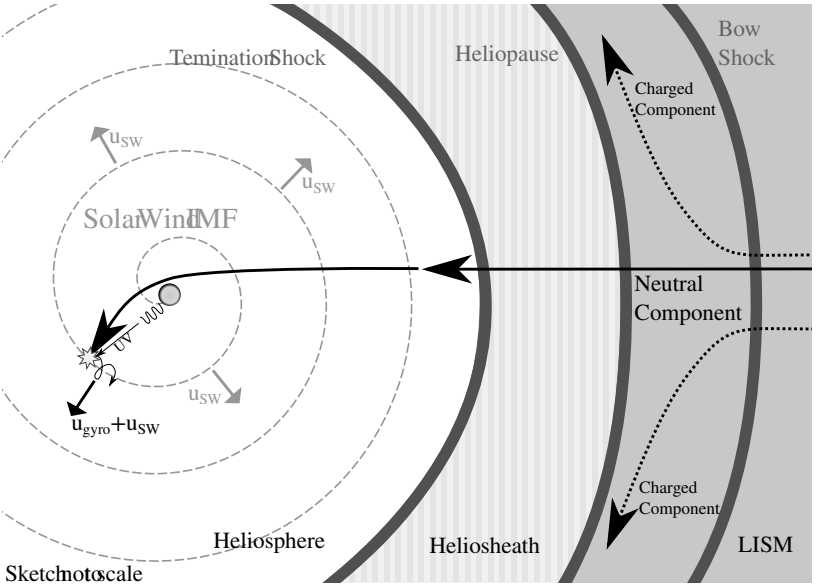
LISM
Sketch not to scale


Termination Shock
Heliopause
Bow Shock
Charged Component
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u_{SW}
Solar Wind
IMF
UV
Neutral Component
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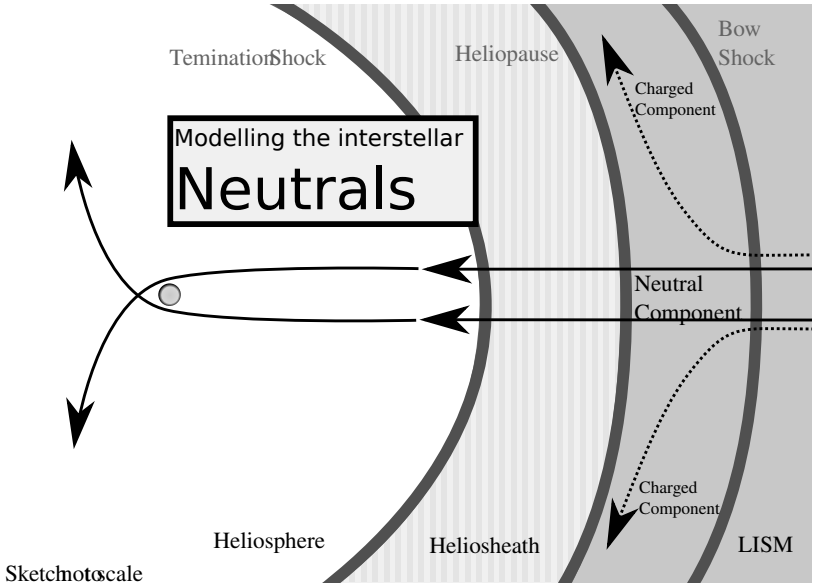
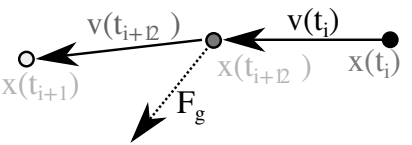
$u_{gyro}+u_{SW}$
Charged Component
Heliosphere
Heliosheath
LISM
Sketch not to scale

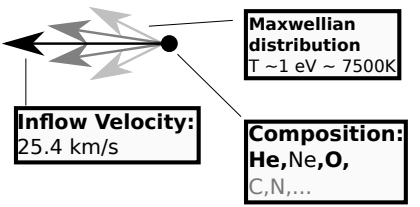

Temination Shock
Heliopause
Bow Shock
Charged Component
Modelling the interstellar
Neutrals
Neutral Component
Charged Component
Heliosphere
Heliosheath
LISM
Sketch not to scale

Timestep-Integration



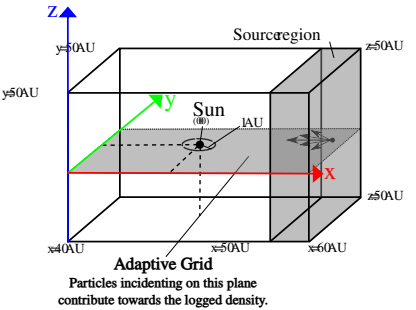
$$\vec{F_g} = -G\frac{M_s \cdot m}{r^3}|\vec{r}| \propto r^{-2} \cdot \frac{\vec{r}}{|\vec{r}|}$$

The LISM
Boundary Conditions



Simulation setup

Simulation-Space



Adaptive grid overview

	-40 AU	-20 AU	0 AU	20 AU	40 AU	60 AU
50 AU	20x20 (1AU/div)	20x20 (1AU/div)	20x20 (1AU/div)	20x20 (1AU/div)	20x20 (1AU/div)	
30 AU	20x20 (1AU/div)	800x800 (0.25AU/div)	800x800 (0.25AU/div)	20x20 (1AU/div)	20x20 (1AU/div)	
10 AU	800x800 (0.25AU/div)	2000x2000 (0.01AU/div)	2000x2000 (0.01AU/div)	800x800 (0.25AU/div)	20x20 (1AU/div)	
-10 AU	20x20 (1AU/div)	800x800 (0.25AU/div)	800x800 (0.25AU/div)	20x20 (1AU/div)	20x20 (1AU/div)	
-30 AU	20x20 (1AU/div)	20x20 (1AU/div)	20x20 (1AU/div)	20x20 (1AU/div)	20x20 (1AU/div)	
-50 AU						

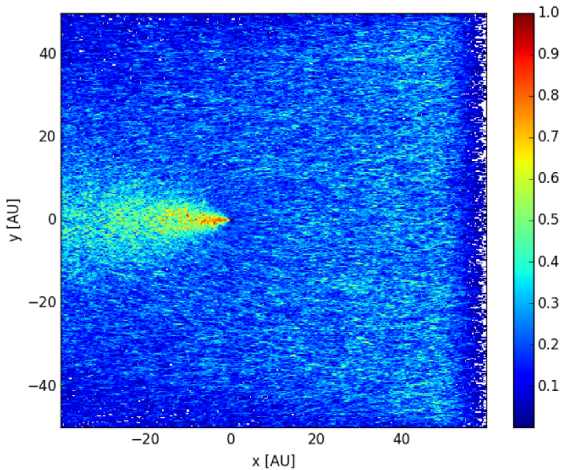
Summary:

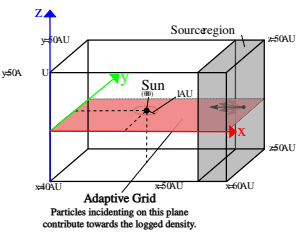
3 groups of resolution
-1AU/div: 400 Pts/grid
-0.25AU/div:6400 Pts/grid
-0.01AU/div: 4M Pts/grid

Alltogether:
8405200 Pts

Preliminary Results

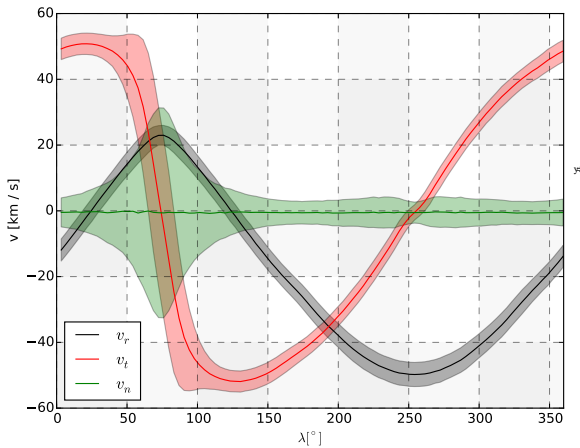
He neutral density

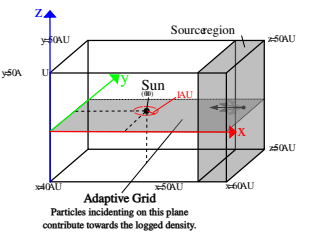


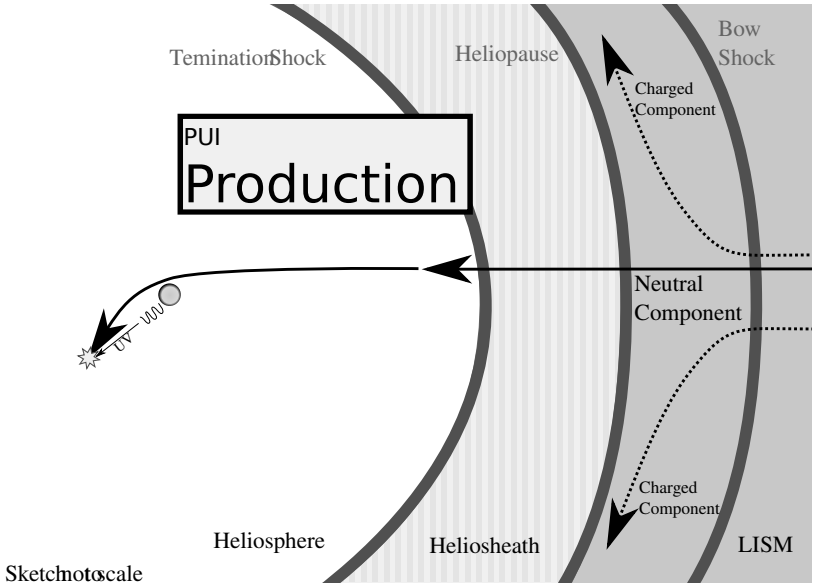


Preliminary Results

O Neutral VDF at 1 AU



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Ionisation, statistical model for particle

Ionization processes

Photoionization

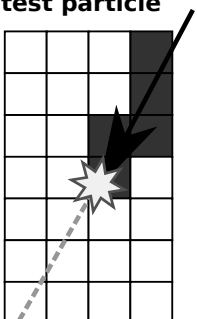
$$P_{ion} \propto r^{-2}$$

Charge-Exchange

$$P_{ion} \approx\propto r^{-2}$$

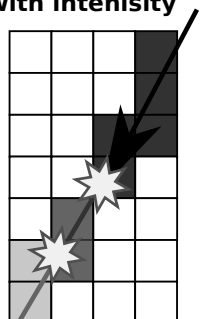
Problem: low number of incident particles

Simple test particle



Low count rates due to particle losses

test particle with intenisity



Better intensity profiles since the particle is tracked on