

δf PIC with FBL bulk densities

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slides for TSVV10 kick-off

Outline

- 1 Towards a FBL- δf PIC code
- 2 Preliminary numerical results

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δf PIC and FBL bulk densities

● PIC- δf ansatz

$$f^n = f_0 + \delta f^n$$

- ▶ f_0 : explicit **bulk density** – typically a Maxwellian profile
- ▶ δf^n : **residual density** solved with PIC

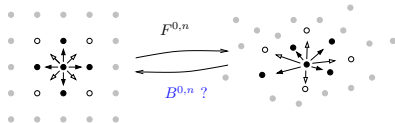
$$\delta f^n(z) = \sum_{k=1}^{N_p} \delta w_k^n \varphi_\varepsilon(z - z_k^n) \quad \text{with} \quad \delta w_k^n := \frac{f^n(z_k^n) - f_0(z_k^n)}{N_p g^n(z_k^n)} \quad (\text{direct weighting})$$

- ▶ usually $|\delta f^n| \ll f_0$: **denoising effect**, control variate interpretation¹
- ▶ **problem** : in some regimes, f^n deviates a lot from a Maxwellian

● alternative : FBL- δf ansatz

$$f^n = f_*^n + \delta f^n$$

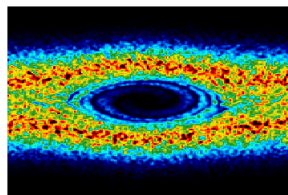
- ▶ δf^n : PIC, as above
- ▶ f_*^n : bulk density represented on a **coarse grid**
- ▶ periodically updated using an **FBL method**



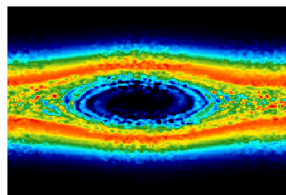
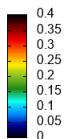
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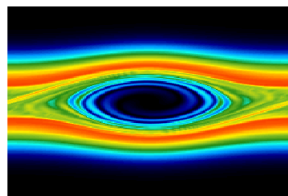
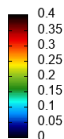
Densities $f(x, v)$ in a TSI : method | N_p | N_*



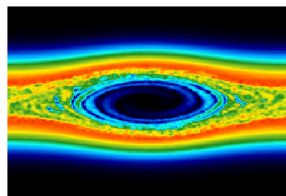
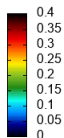
PIC : f | 6.5e4 | (4e3)



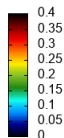
δf -PIC : f | 6.5e4 | 4e3



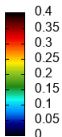
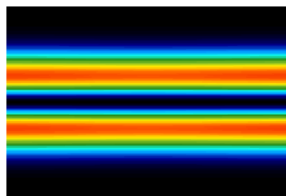
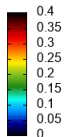
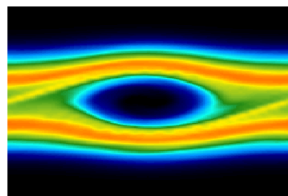
FBL ($f = f_*$) | 0 | 6.5e4



FBL δf -PIC : f | 6.5e4 | 4e3

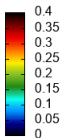
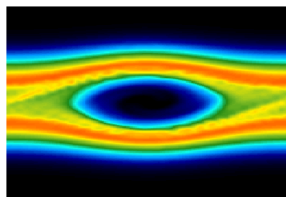
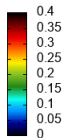
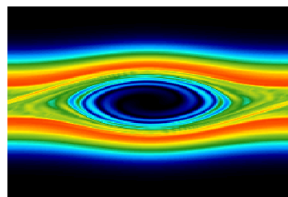


Bulk densities $f_*(x, v)$ in a TSI : method | N_p | N_*



PIC (post-processed f_*) | 6.5e4 | (4e3)

δf -PIC : f_0 | 6.5e4 | 4e3



FBL ($f = f_*$) | 0 | 6.5e4

FBL δf -PIC : f_* | 6.5e4 | 4e3