

Andrew Harris

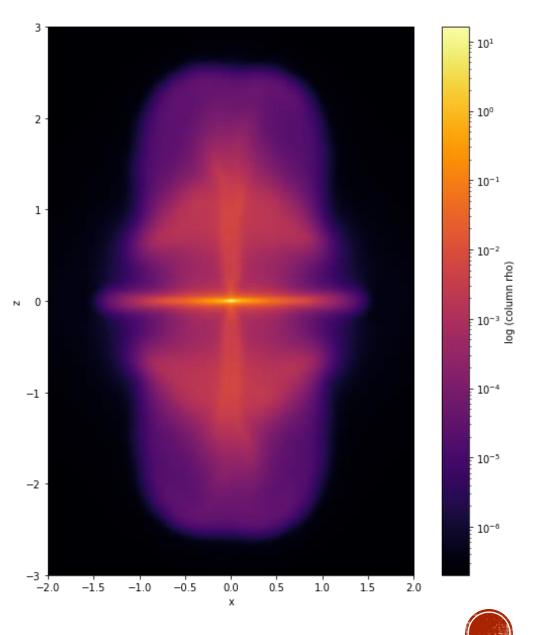
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## SARRACEN

- Sarracen is a Python-based tool for analysis and visualization of SPH data dumps.
  - It can seamlessly read binary data dumps produced by Phantom.
  - Rendering 2D images / line plots of SPH datasets
  - Scriptable filtering and analysis of SPH data
  - Highly customizable figure creation

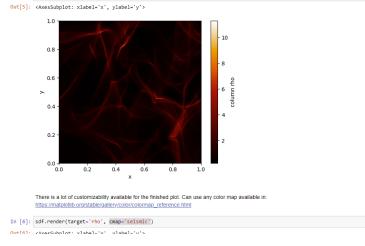


### PYTHON & JUPYTER NOTEBOOKS

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	Data	iset Prop	erties									
In [4]: Out[4]:	sdf.describe()											
		iorig	x	у	z	vx	vy	vz	h	alpha	divv	
	count	1.677722e+07	1.677722e+07	1.677722e+07	1.677722e+07	1.677722e+07	1.677722e+07	1.677722e+07	1.677722e+07	1.677722e+07	1.677722e+07	1.677
	mean	8.388608e+06	5.290248e-01	5.120762e-01	5.000172e-01	-3.023684e-04	-1.374925e-03	4.389142e-03	3.482727e-03	6.465954e-01	2.748958e+00	-7.312
	std	4.843165e+06	2.841829e-01	2.879270e-01	2.873136e-01	5.278154e+00	6.799726e+00	4.729440e+00	1.947915e-03	2.834403e-01	2.855185e+02	3.741
	min	1.000000e+00	3.610313e-08	1.864370e-08	2.515395e-08	-1.736459e+01	-1.811643e+01	-1.750667e+01	5.992065e-04	0.000000e+00	-4.699914e+03	-5.718
	25%	4.194305e+06	2.983247e-01	2.716252e-01	2.594746e-01	-3.633681e+00	-4.871933e+00	-3.040725e+00	2.185197e-03	4.946052e-01	-7.143256e+01	-1.411
	50%	8.388608e+06	5.163255e-01	4.939822e-01	5.026946e-01	5.429676e-02	-3.211423e-01	2.884163e-01	2.953386e-03	6.830860e-01	7.097498e+01	-7.562
	75%	1.258291e+07	7.987416e-01	7.742302e-01	7.476748e-01	3.692336e+00	4.662609e+00	3.217132e+00	4.176375e-03	8.816663e-01	1.499973e+02	1.236
	max	1.677722e+07	1.000000e+00	1.000000e+00	1.000000e+00	1.707275e+01	2.480948e+01	1.647887e+01	1.689522e-02	1.000000e+00	2.111220e+03	6.592
	4											۱.

Basic column rendering can be performed with one line. 'target' is the rendered value, which can be replaced with any column of the dataset

In [5]: sdf.render(target='rho') # Column rendering



- Using Python allows for easy modification of output
- SPH analysis can be easily augmented with available statistical and mathematical tools.
  - For example, powerful functions that are available in NumPy and SciPy
  - Integrated very well with matplotlib and pandas
- Jupyter Notebooks can be utilized with Sarracen, providing a great platform for exploring and sharing SPH data.
  - Can be used remotely, or on a local machine.



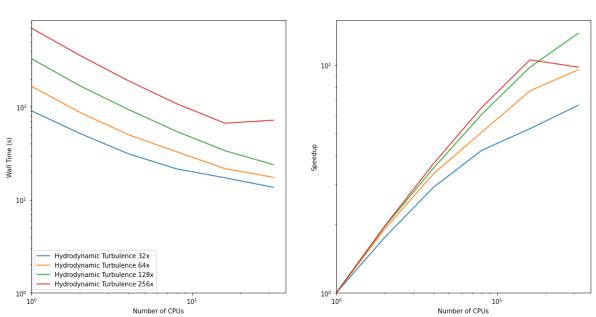
## **INSTALLATION INSTRUCTIONS**

- We are hosted on PyPI!
  - pip install sarracen
- To import:
  - import sarracen as sar
- Source code is available at:
  - <u>https://github.com/ttricco/sarracen</u>
- We have full documentation:
  - https://sarracen.readthedocs.io/en/latest/index.html
- Documentation includes:
  - Installation Guide
  - Quick Start Guide
  - Usage examples, from basic to advanced examples
  - Full API



# MULTITHREADING AND GPU (CUDA)

- SPH Interpolation is expensive; we were concerned that high-level Python would not yield acceptable performance.
- To minimize this issue, we have taken several steps:
  - All performance-intensive interpolation functions are compiled into parallelized machine code with numba. (This compilation is JIT, so the first call of any function will have some overhead)
  - All interpolation functions can also be executed on a CUDA-enabled GPU.



2500x2500 3D Projective Interpolation



# RELATIONSHIP TO SPLASH

- Sarracen complements Splash, they both fill different roles.
- Splash:
  - Splash generally has faster performance than Sarracen.
  - Splash is excellent for initial explorations of datasets.
- Sarracen
  - Sarracen excels at deeper analysis of SPH datasets
  - Sarracen allows for production of highly customizable plots.



#### USAGE DEMO

• Here, I will demonstrate some useful features of Sarracen in a Jupyter Notebook.

