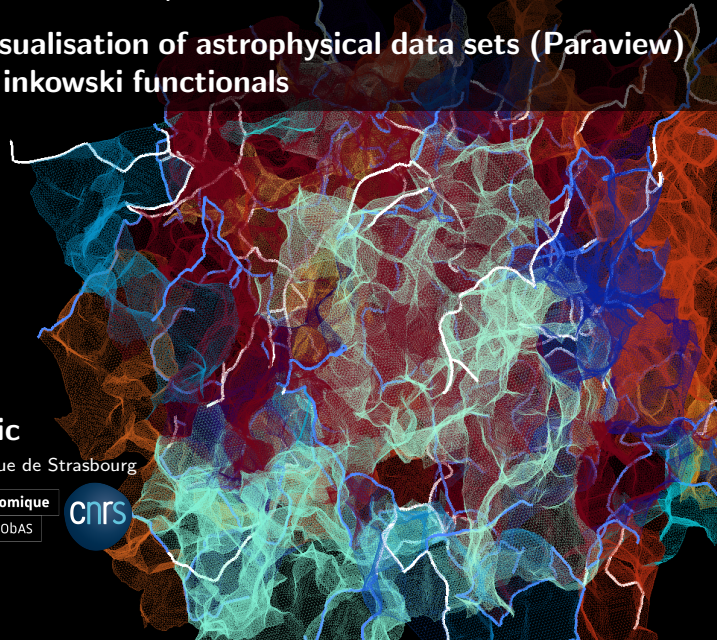



Topological (& geometrical) methods for astrophysical data

- Practical: 1/ Visualisation of astrophysical data sets (Paraview)
2/ Minkowski functionals



Katarina Kraljic

Observatoire astronomique de Strasbourg

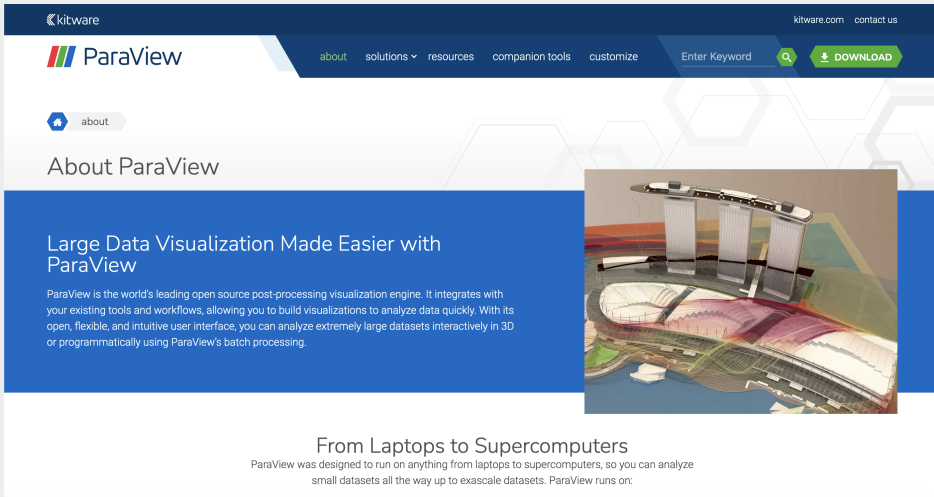
	Observatoire	astronomique
	de Strasbourg ObAS	



Software (minkowski2.1) by Martin Kerscher

- [minkowski2.1](https://homepages.physik.uni-muenchen.de/~Martin.Kerscher/software/) (<https://homepages.physik.uni-muenchen.de/~Martin.Kerscher/software/>)
- computes Minkowski functionals of a Boolean grain model with boundary correction

- open source post-processing visualization engine
- uses the Visualization Toolkit (VTK) as the data processing and rendering engine
- **webpage:** <https://www.paraview.org>



The image shows a screenshot of the Paraview website. At the top, there is a dark blue navigation bar with the Kitware logo on the left and links for 'kitware.com' and 'contact us' on the right. Below this is a white header area with the Paraview logo on the left and a navigation menu with links for 'about', 'solutions', 'resources', 'companion tools', and 'customize'. A search bar with the text 'Enter Keyword' and a magnifying glass icon is also present, along with a green 'DOWNLOAD' button. The main content area has a blue background on the left with the heading 'About ParaView' and a sub-heading 'Large Data Visualization Made Easier with ParaView'. Below this is a paragraph of text describing Paraview's capabilities. On the right, there is a 3D visualization of a dam structure with water flow simulation. At the bottom, there is a section titled 'From Laptops to Supercomputers' with a paragraph explaining Paraview's scalability.

kitware

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ParaView

about solutions resources companion tools customize

Enter Keyword

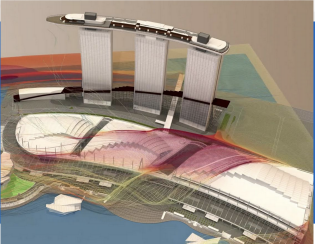
DOWNLOAD

about

About ParaView

Large Data Visualization Made Easier with ParaView

ParaView is the world's leading open source post-processing visualization engine. It integrates with your existing tools and workflows, allowing you to build visualizations to analyze data quickly. With its open, flexible, and intuitive user interface, you can analyze extremely large datasets interactively in 3D or programmatically using ParaView's batch processing.



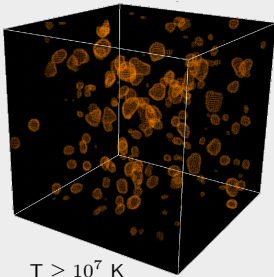
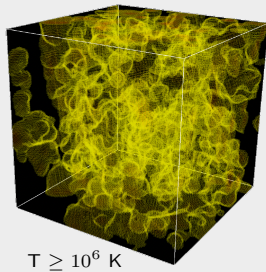
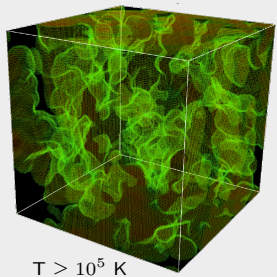
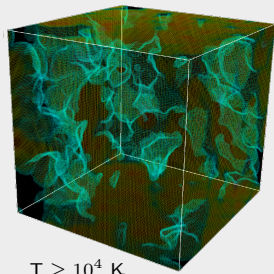
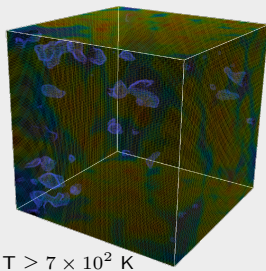
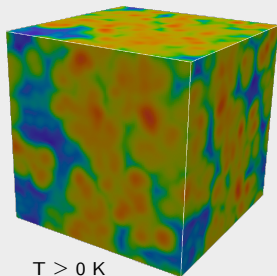
From Laptops to Supercomputers

ParaView was designed to run on anything from laptops to supercomputers, so you can analyze small datasets all the way up to exascale datasets. ParaView runs on:

Hydrodynamic simulation: baryonic physics

Simba: cosmological simulation (Davé et al. 2021 [arXiv:astro-ph/1901.10203](https://arxiv.org/abs/1901.10203))

Excursion sets



Hydrodynamic simulation: baryonic physics

File preparation:

→ temperature field: **T_m50n512_s50j7k_151_128.asc**

→ convert numpy array into .vtk file using pyevtk package

→ pip instal pyevtk

or

conda install -c conda-forge pyevtk

→ from pyevtk.hl import gridToVTK

...

gridToVTK(file, x, y, z, cellData = "temperature" : field_smth)

→ structured grid: **T_m50n512_s50j7k_151_128.vts**

Paraview:

→ load file: **T_m50n512_s50j7k_151_128.vts**

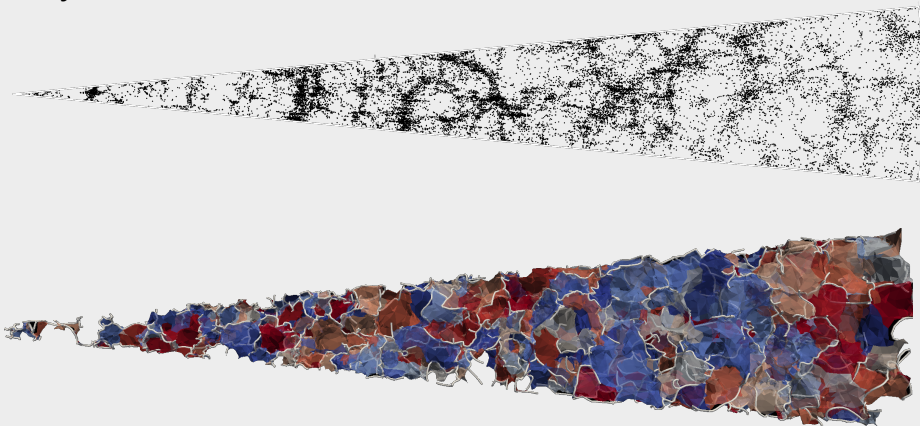
→ thresholding the data: apply *Threshold*

→ creating 2d maps: apply → *Slice*

→ *CellDatatoPointData*

→ *Contour*

Galaxy distribution



- `G12_19p8_fofgt6_s3Mpc_dtfe_SD0_S5_K1.vtu` → DTFE information
- `G12_19p8_fofgt6_s3Mpc_dtfe_SD0_S5_K1.vtp` → filaments
- `G12_19p8_fofgt6_s3Mpc_dtfe_SD0_S5_K1_manifolds_J1a.vtu` → walls
- `G12_19p8_fofgt6_s3Mpc_dtfe_SD0_S5_K1_manifolds_J0a.vtu` → voids