CSC 7700: Scientific Computing

Module A: Basic Skills

Lecture 5: 3D Visualization using Visit

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Installing Visit

https://wci.llnl.gov/codes/visit/executables.html

- Linux
- Max OS X
- Windows

Data to visualize

Download (checkout/update) dataset from class repository:
https://svn.cct.lsu.edu/repos/courses/sci-comp-2013-public/coursework/A5/rho.rl4.h5

About the dataset:

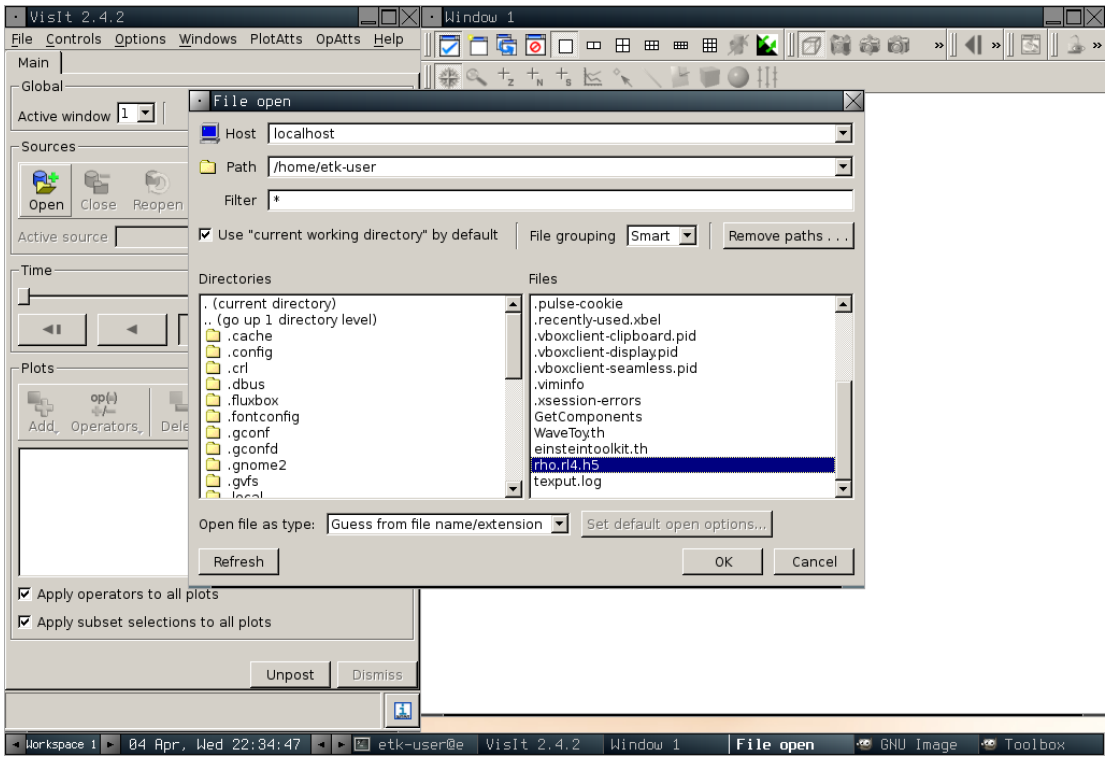
- 3D dataset
- time-series
- density of pulsating neutron star

About the Format:

- HDF5
- Hierarchical Data Format
- data model, library, and file format for storing and managing data
- optimized for large datasets and parallel I/O
- portable
- free library (open source)

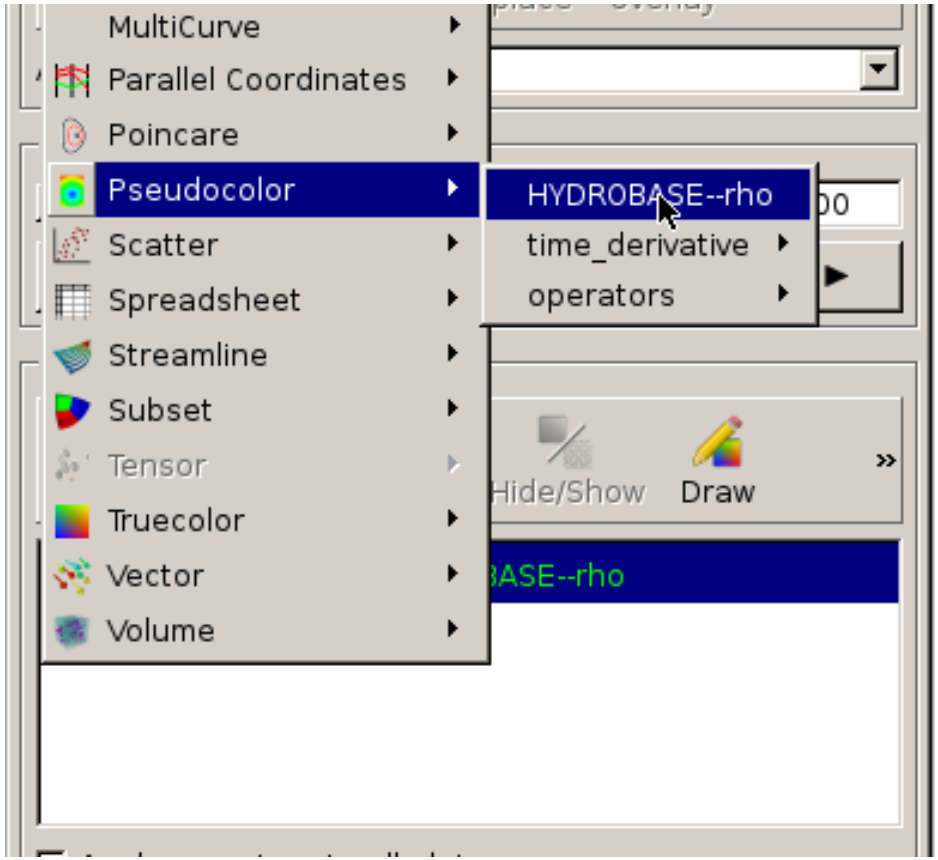
Visualizing density oscillations

- Start Visit
- You can try enabling 3D acceleration, but at least on Intel graphics chips this tends to make VisIt fail at startup.
- open the output file of your choice



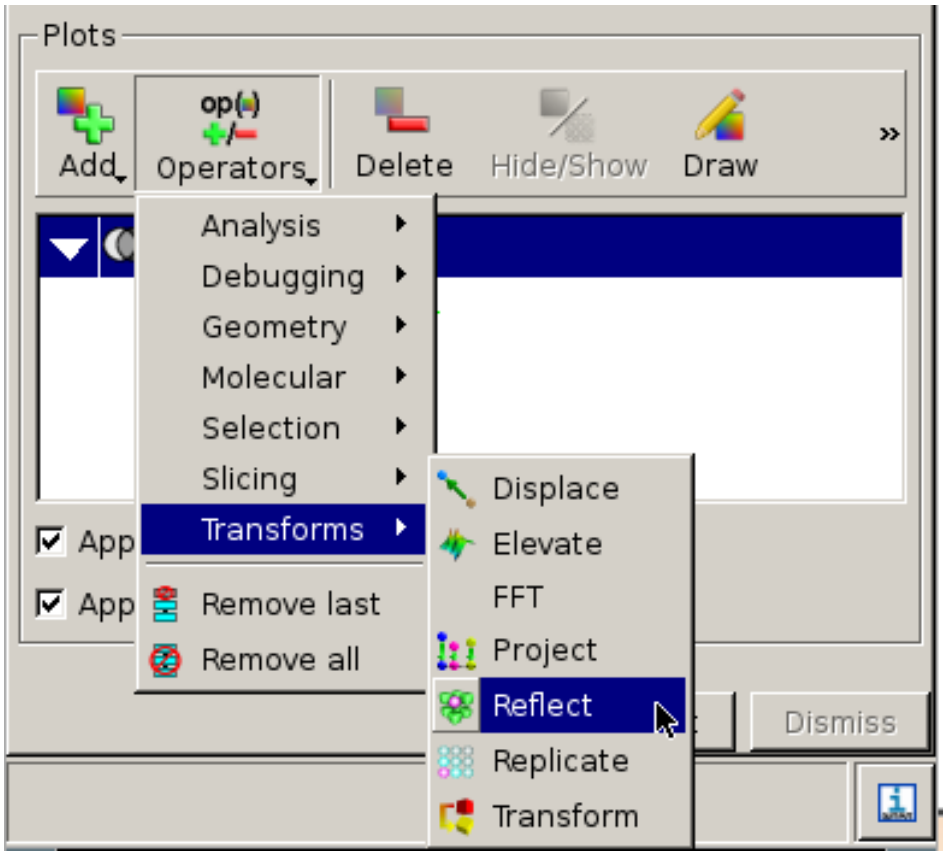
Visualizing density oscillations

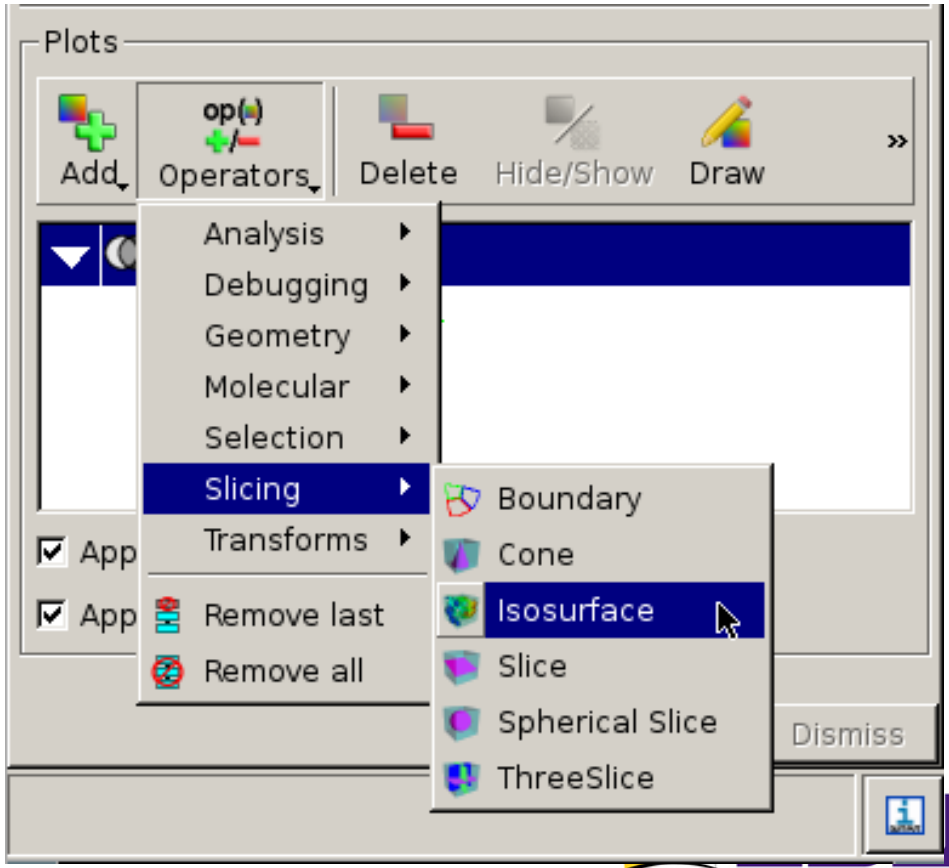
- add a pseudocolor plot from the "Plots" drop-down button
- we will display a number of isocontour lines in the star to show its oscillations
- we will use the `Isosurface` operator to compute the contour surfaces
- `VisIt` also offers a `Contour` plot which however is limited in the transparency options compared to the `Isosurface`, `PseudoColor` combination we use



Visualizing density oscillations

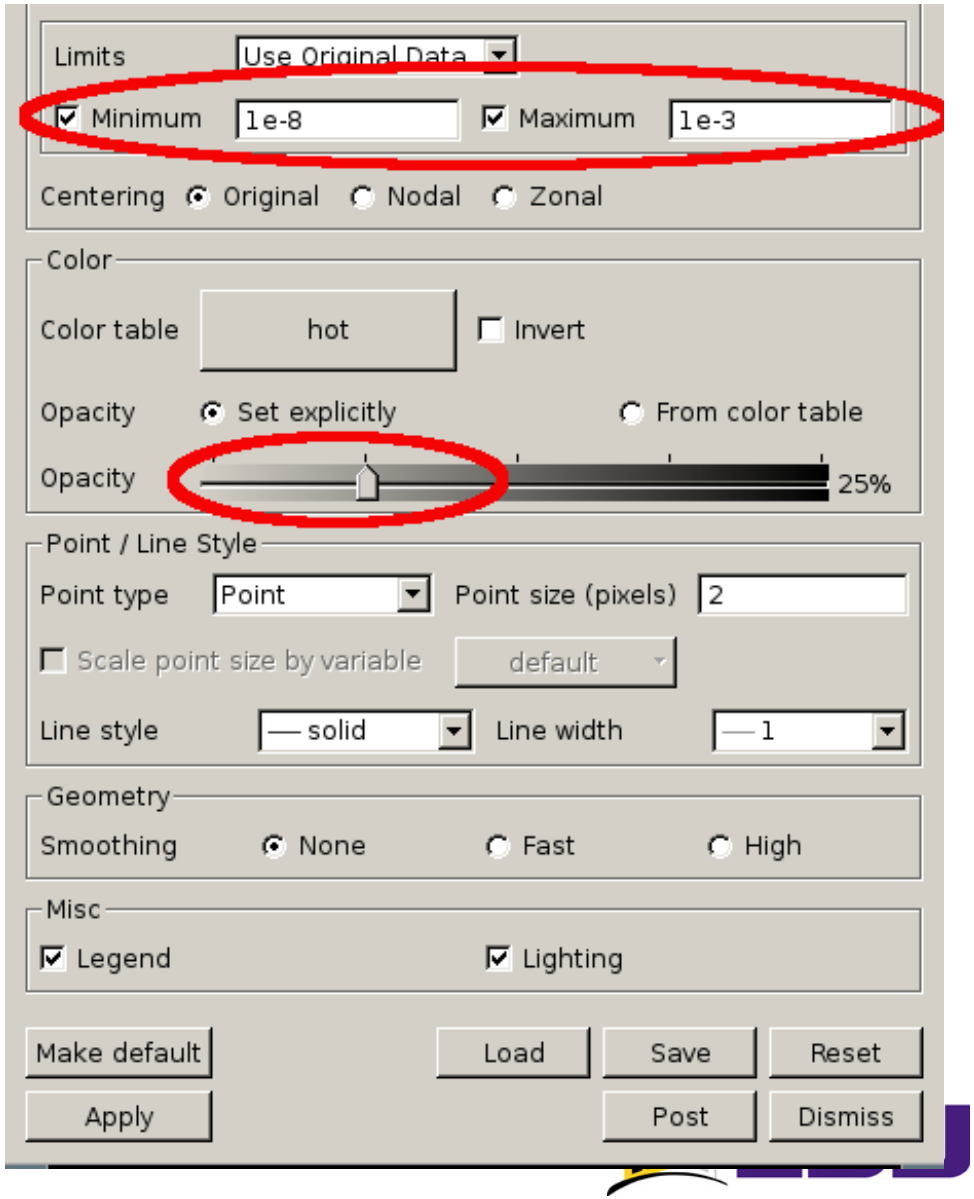
- add `Isosurface` operator from `Operators/Slicing/Isosurface`
- add `Reflect` operator from `Operators/Transforms/Reflect`, to populate the "missing" octants





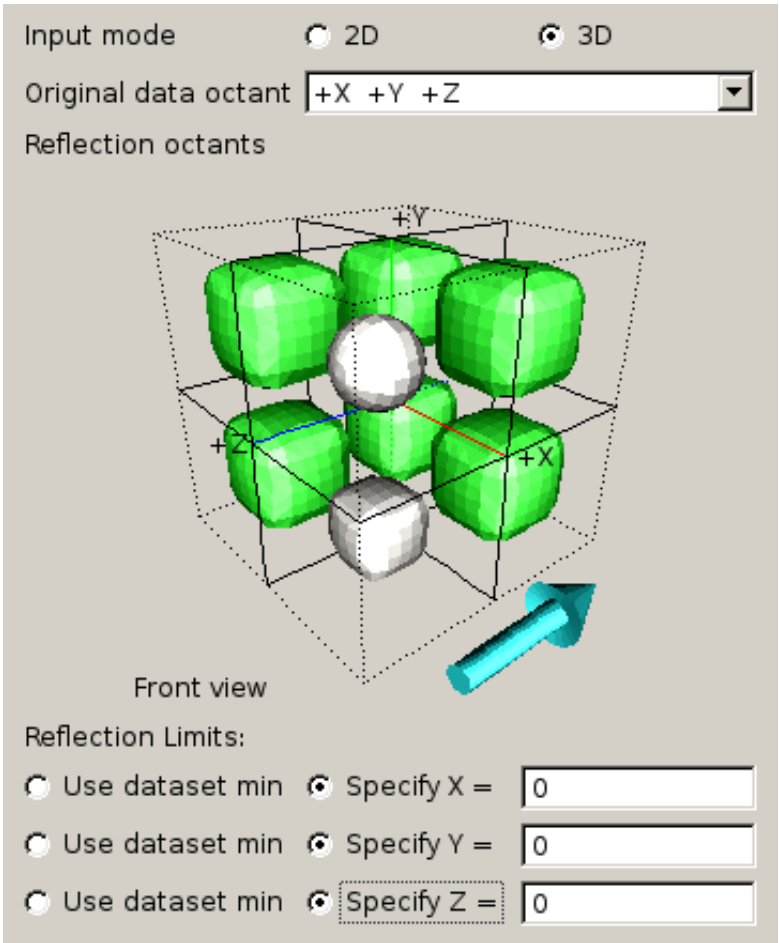
Visualizing density oscillations

- double-click on the `Pseudocolor` entry in the list of plots to display its options page. Your might have to expand the list using the triangle shaped button on the left first
- add transparency by reducing the opacity to about 25% and set limits of $[10^{-8}, 10^{-3}]$ for the plot range. We will use the same range when creating isocontours in the next step
- you have to click on `Apply` then on `Dismiss` to apply the new settings



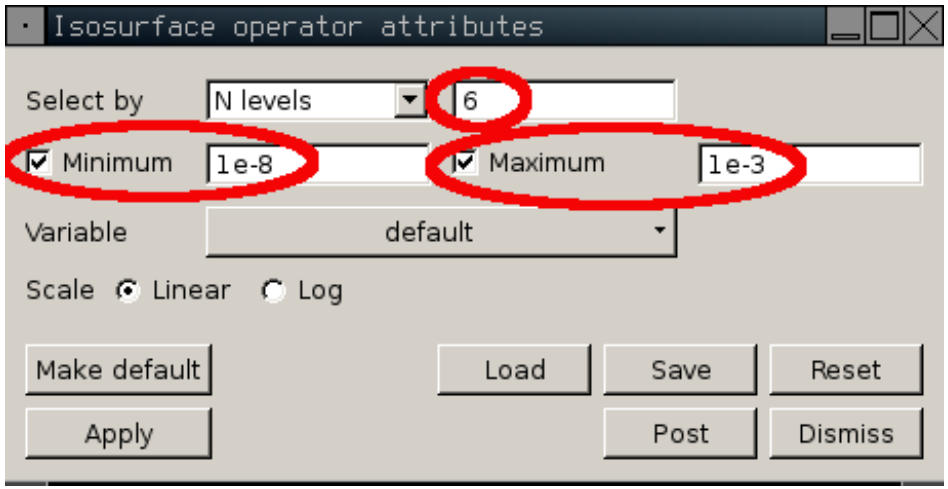
Visualizing density oscillations

- double click on the `Reflect` operator, change to `3D` and activate all octants except the original $(+X + Y + Z)$ one and the $+X - Y + Z$ one, change the reflection point to the origin.



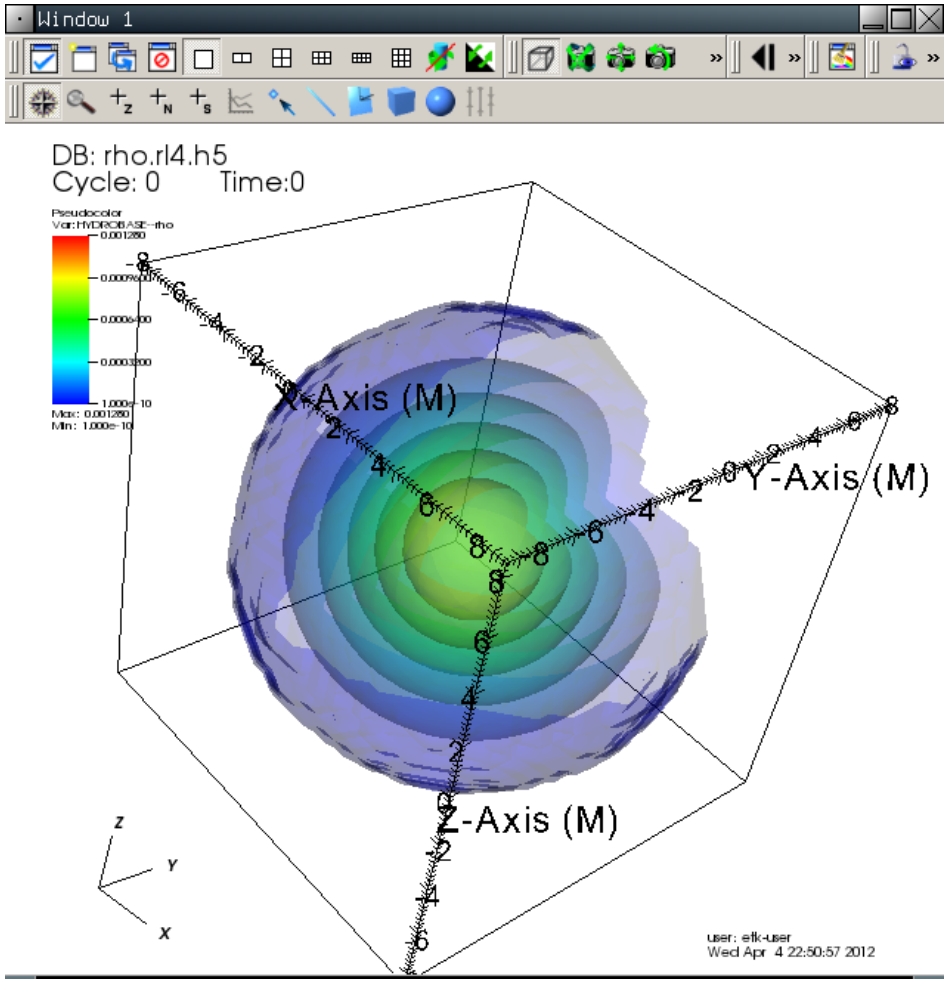
Visualizing density oscillations

- double click on the `Isosurface` operator and select the range used for the `Pseudocolor` plot, use 6 levels and leave the scaling at `linear`



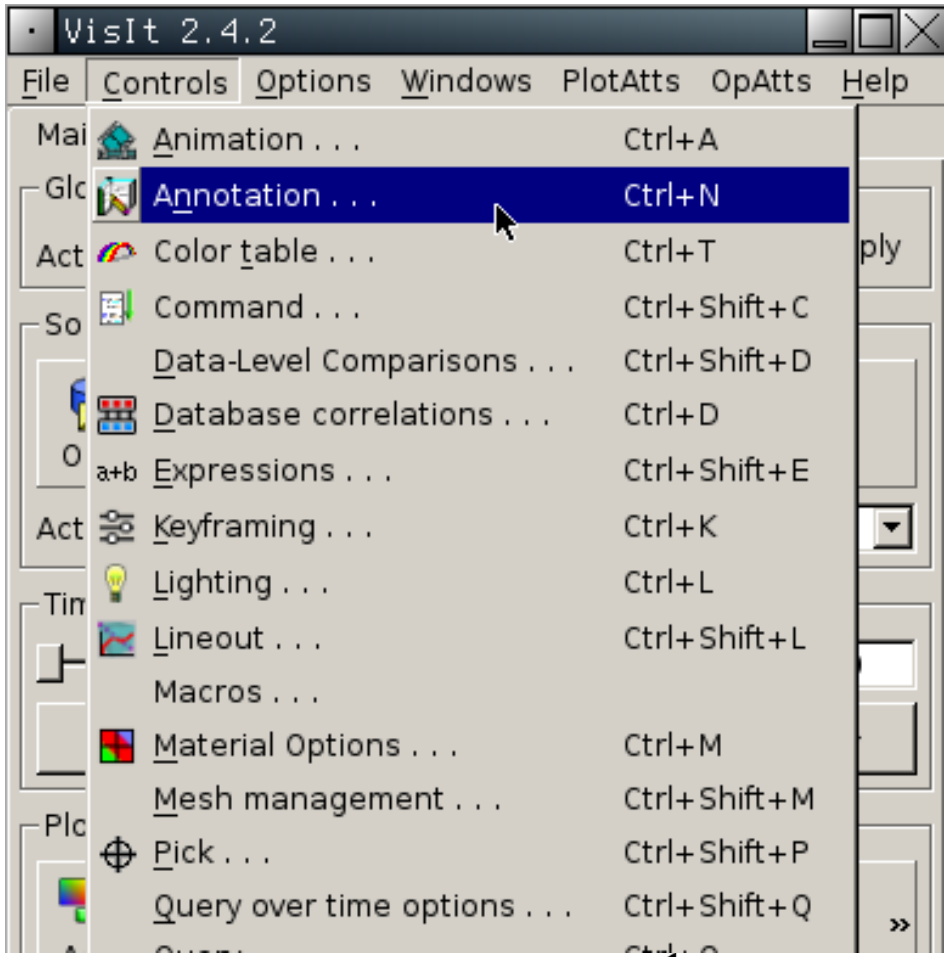
Visualizing density oscillations

- click on `Draw` to see how your plot looks like
- rotate to an orientation that looks nice, by grabbing the plot with the mouse



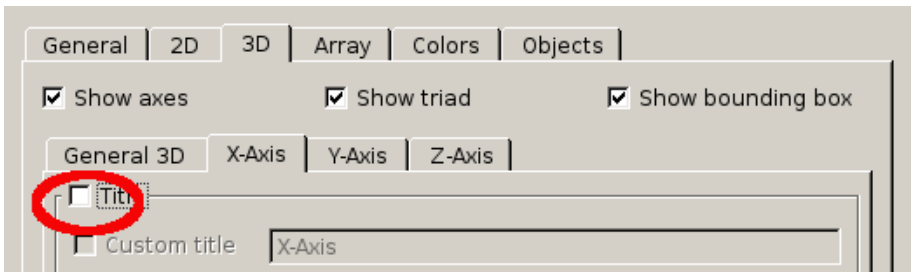
Visualizing density oscillations

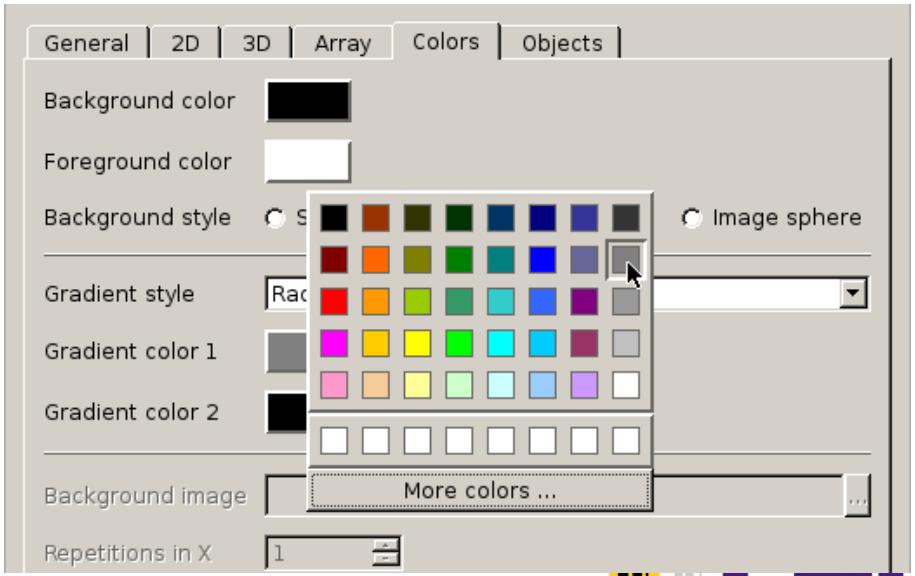
- next we will change `VisIt`'s rendering options to add shadows and change the background to something more attractive
- unfortunately this means we will eventually loose the transparancy. Though fiddling with the `Screen capture` option in `File/Save Window Options...` Experiment!
- first though open the `Annotation` control page



Visualizing density oscillations

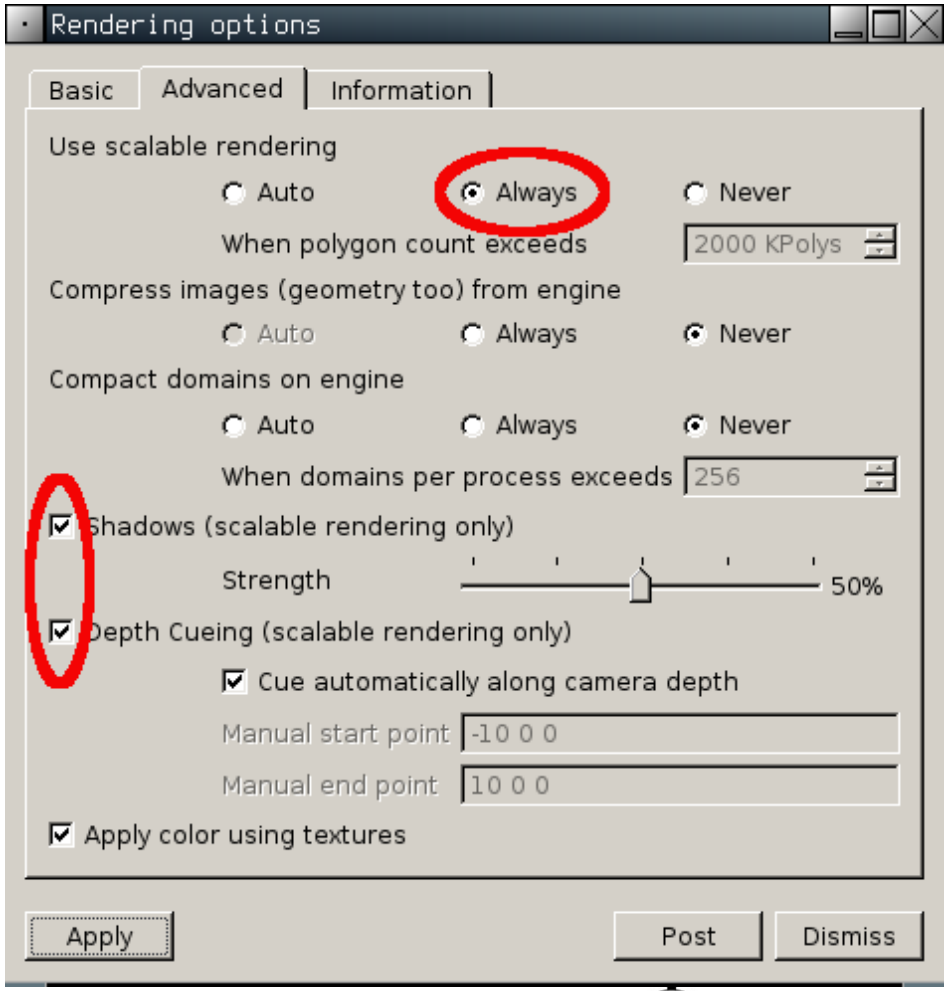
- in the `X-Axis` subtab of the `3D` tab, disable the axis title
- repeat for the other two axes
- in the `Colors` tab, change the background to black and the foreground to white
- add a gradient to the background, with a dark gray as the second colour





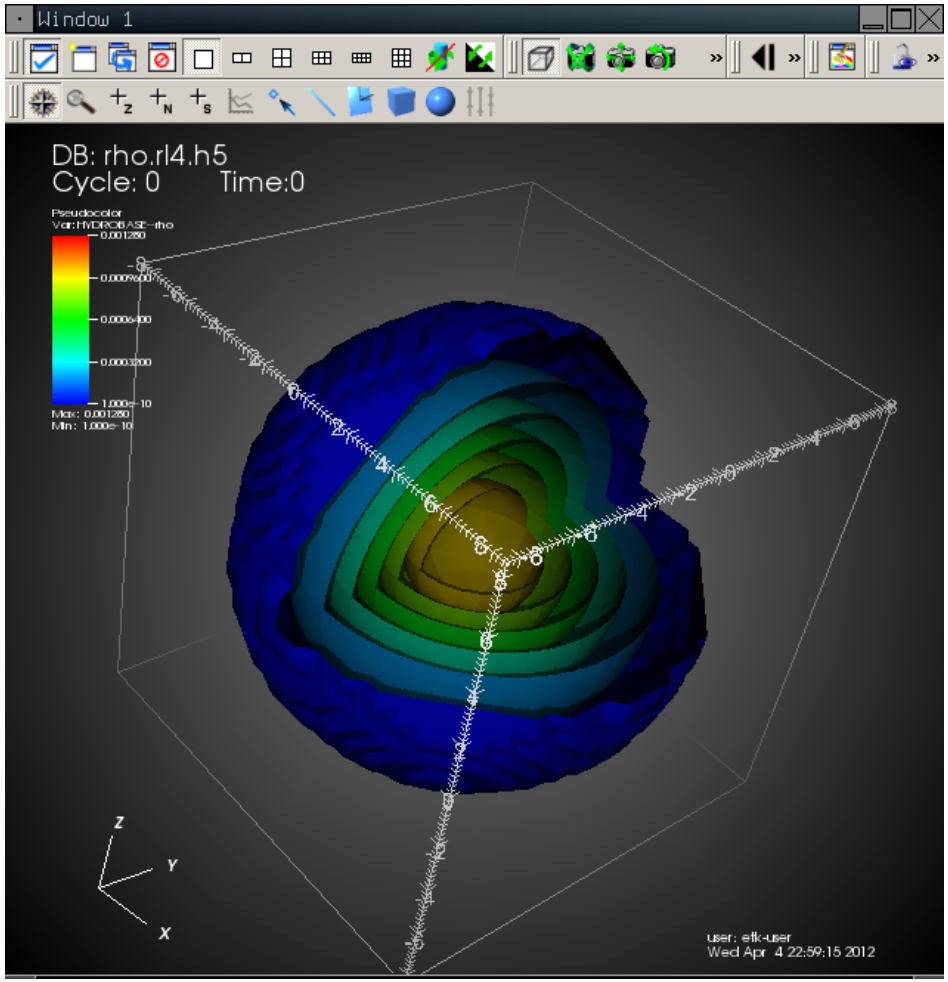
Visualizing density oscillations

- open `VisIt`'s rendering options from the `Options/Rendering...` menu
- on the `Advanced` tab, enable `scalable rendering`, `Shadows` and `Depth Cueing`



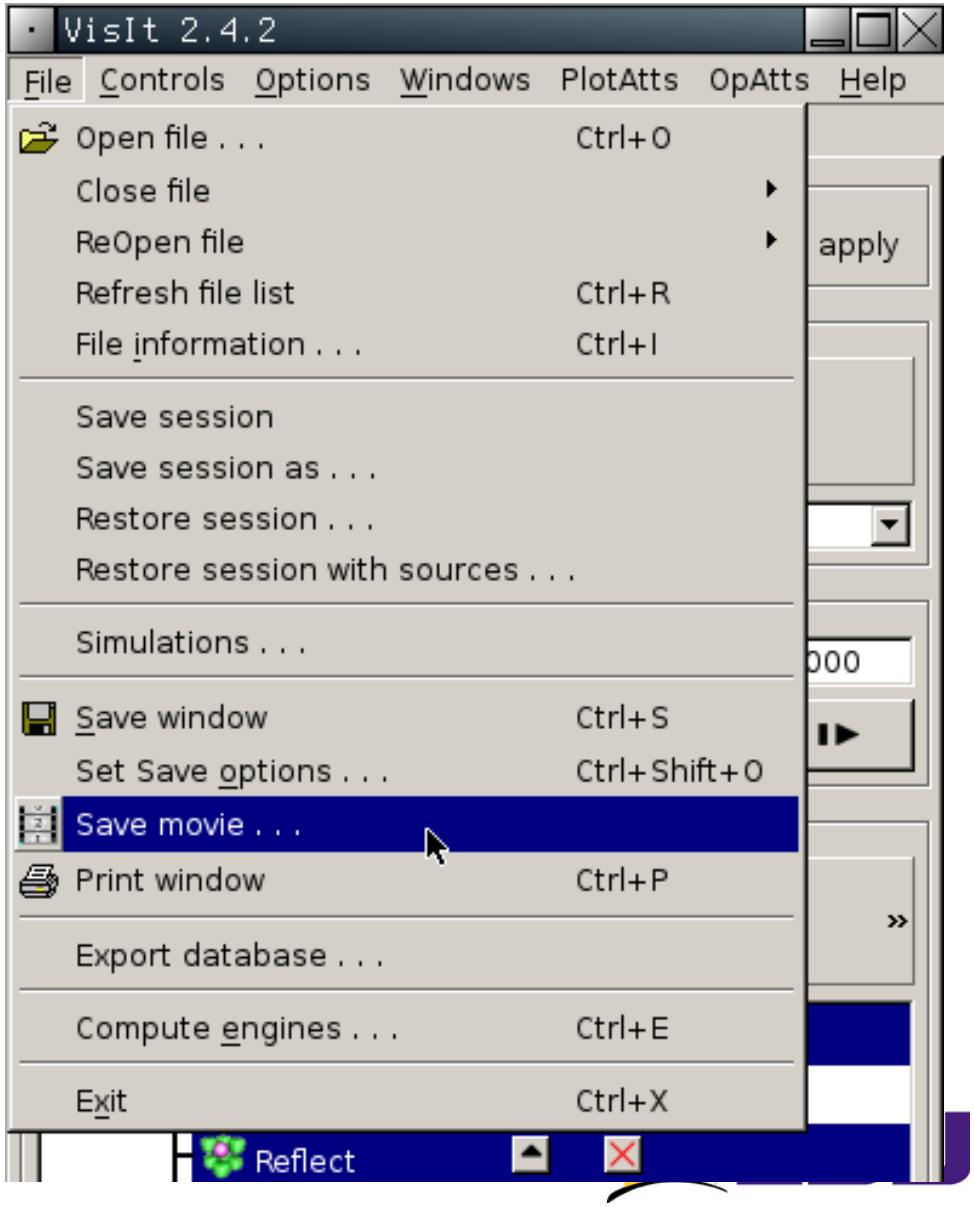
Visualizing density oscillations

- click on `Draw` to see how your plot looks like



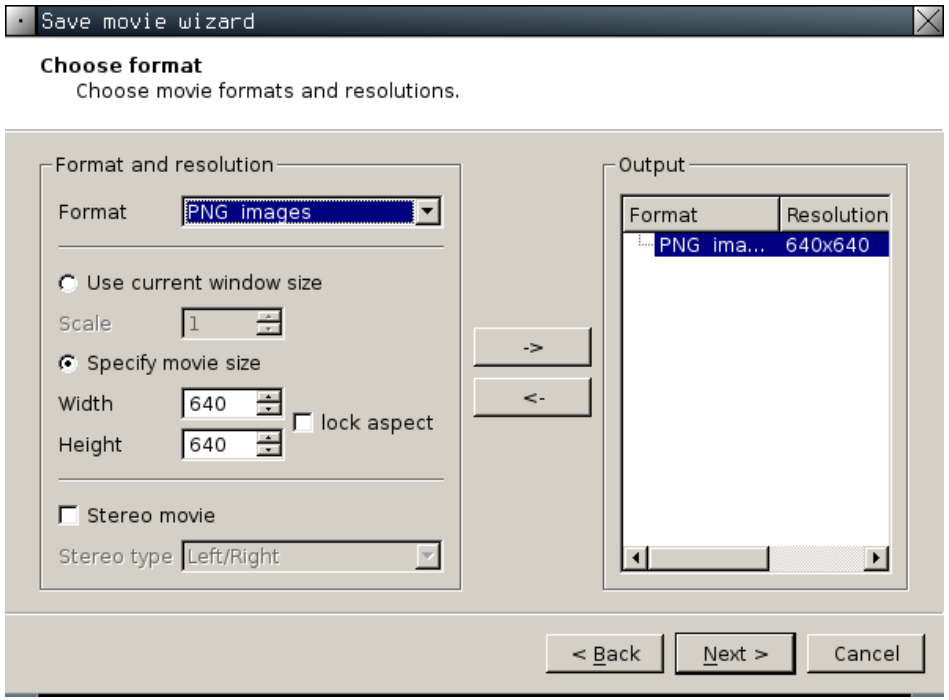
Visualizing density oscillations

- in this last step we will let `VisIt` rendering frames of a small movie showing the oscillations
- to start the movie wizard, select `Save movie...` from the `File` menu



Visualizing density oscillations

- Finally, inside the wizard, change the frame size to approximately 640×640 pixels (multiples of 16 are best)
- choose `png` output
- add the movie format to the list on the right using the -> button
- click on next and accept the defaults for all other steps, maybe choosing a different output directory for the frames



Visualizing density oscillations

- once `VisIt` is done, which will take some minutes, we can render the frames into an actual movie
- for this, `cd` into the folder containing the frames and use, e.g., ffmpeg:

```
ffmpeg -loop_input -vframes 200 -qscale 1 -b 1000
-i movie%04d.png movie.avi
```

  - `-loop_input` makes `ffmpeg` wrap around when looking for frames
  - `-vframes 200` is the number of frames to include in the movie, we set this to twice as many as we have actual frames, ie. the movie will loop twice
  - `-qscale 1` sets the quality scale for the encoder. 1 is best quality.
  - `-b 1000` asks for a bitrate of 1000 kilobits per second
  - `-i movie%04d.png` tells `ffmpeg` the names of the input files, it accepts `printf` format specifiers to construct a file name based on the frame number. `ffmpeg` stops encoding once it generates a name for which no or no valid file is found.

- play the movie, e.g., using `ffplay`

Course Work

Follow the previous steps to generate a sequence of images.

- don't write-up these steps again in your report
- be sure to add all problems/obstacles you encountered
- select two images of the sequence - one close to (but not of) the first timestep, and one close (but not of) the end.
- Add these images to the report (include them in the pdf file, don't add the file separately)
- commit the single-file report to your repository (coursework/A5)
- Emphasis not on reproducing images identically, but on effort to gain experience

Due: Fri, Sep 20th 2013