

Finding Clumps

```
In [1]: import numpy as np
import yt
from yt.analysis_modules.level_sets.api import *

ds = yt.load("IsolatedGalaxy/galaxy0030/galaxy0030")
```

Choose a data container in which to find clumps.

```
In [2]: data_source = ds.disk([0.5, 0.5, 0.5], [0., 0., 1.],
                             (8, 'kpc'), (1, 'kpc'))
```

Choose the field to contour.

```
In [3]: field = ("gas", "density")
```

Choose the contour step size.

```
In [4]: step = 2.0
```

Set clean minimum and maximum contour values.

```
In [5]: c_min = 10**np.floor(np.log10(data_source[field]).min() )
c_max = 10**np.floor(np.log10(data_source[field]).max()+1)
print c_min, c_max

1e-28 1e-23
```

Create the root level clump.

```
In [6]: master_clump = Clump(data_source, field)
```

Add a function to decide which clumps are good.

We will require a minimum number of cells (20).

```
In [7]: master_clump.add_validator("min_cells", 20)
```

Begin clump finding!

```
In [9]: find_clumps(master_clump, c_min, c_max, step)
```

Write out clump information.

```
In [10]: write_clump_index(master_clump, 0, "%s_clump_hierarchy.txt" % ds)
write_clumps(master_clump, 0, "%s_clumps.txt" % ds)
```

```
In [12]: !cat galaxy0030_clump_hierarchy.txt
```

```
Clump at level 0:
Cells: 100134.
Mass: 1.296926e+09 Msun.
Jeans Mass (mass-weighted): 4.746875e+09 Msolar.
Jeans Mass (volume-weighted): 1.223489e+11 Msolar.
Max grid level: 8.
Min number density: 1.661908e-04 cm-3.
Max number density: 5.601262e+00 cm-3.
```

```
    Clump at level 1:
      Cells: 8860.
      Mass: 9.096365e+08 Msun.
      Jeans Mass (mass-weighted): 6.197542e+07 Msolar.
      Jeans Mass (volume-weighted): 6.370615e+07 Msolar.
      Max grid level: 8.
      Min number density: 7.906667e-01 cm-3.
      Max number density: 5.601262e+00 cm-3.
```

```
        Clump at level 2:
          Cells: 94.
          Mass: 1.784123e+07 Msun.
          Jeans Mass (mass-weighted): 6.287895e+07 Msolar.
          Jeans Mass (volume-weighted): 6.269044e+07 Msolar.
          Max grid level: 8.
          Min number density: 3.149490e+00 cm-3.
          Max number density: 4.996931e+00 cm-3.
```

```
          Clump at level 2:
            Cells: 44.
            Mass: 8.398611e+06 Msun.
            Jeans Mass (mass-weighted): 3.752320e+07 Msolar.
            Jeans Mass (volume-weighted): 3.751050e+07 Msolar.
            Max grid level: 8.
            Min number density: 3.227206e+00 cm-3.
            Max number density: 3.768973e+00 cm-3.
```

```
            Clump at level 2:
              Cells: 20.
```

Mass: 3.756567e+06 Msun.
Jeans Mass (mass-weighted): 5.057039e+07 Msolar.
Jeans Mass (volume-weighted): 5.010453e+07 Msolar.
Max grid level: 8.
Min number density: 3.196927e+00 cm⁻³.
Max number density: 3.847872e+00 cm⁻³.

Clump at level 2:
Cells: 50.
Mass: 9.548957e+06 Msun.
Jeans Mass (mass-weighted): 1.216713e+08 Msolar.
Jeans Mass (volume-weighted): 1.225884e+08 Msolar.
Max grid level: 8.
Min number density: 3.283816e+00 cm⁻³.
Max number density: 5.068440e+00 cm⁻³.

Clump at level 2:
Cells: 106.
Mass: 2.025443e+07 Msun.
Jeans Mass (mass-weighted): 6.306800e+07 Msolar.
Jeans Mass (volume-weighted): 6.325248e+07 Msolar.
Max grid level: 8.
Min number density: 3.251722e+00 cm⁻³.
Max number density: 4.065772e+00 cm⁻³.

Clump at level 2:
Cells: 20.
Mass: 3.789387e+06 Msun.
Jeans Mass (mass-weighted): 1.890453e+07 Msolar.
Jeans Mass (volume-weighted): 1.894088e+07 Msolar.
Max grid level: 8.
Min number density: 3.193759e+00 cm⁻³.
Max number density: 3.554120e+00 cm⁻³.

Clump at level 2:
Cells: 104.
Mass: 1.966537e+07 Msun.
Jeans Mass (mass-weighted): 8.874298e+07 Msolar.
Jeans Mass (volume-weighted): 8.754599e+07 Msolar.
Max grid level: 8.
Min number density: 3.161182e+00 cm⁻³.
Max number density: 5.285985e+00 cm⁻³.

Clump at level 2:
Cells: 179.
Mass: 3.434637e+07 Msun.
Jeans Mass (mass-weighted): 8.451847e+07 Msolar.
Jeans Mass (volume-weighted): 8.390353e+07 Msolar.
Max grid level: 8.
Min number density: 3.178488e+00 cm⁻³.
Max number density: 5.601262e+00 cm⁻³.

Clump at level 1:
Cells: 106.
Mass: 8.970843e+06 Msun.
Jeans Mass (mass-weighted): 7.889980e+06 Msolar.

Jeans Mass (volume-weighted): 8.621372e+06 Msolar.
Max grid level: 8.
Min number density: 7.960306e-01 cm⁻³.
Max number density: 3.513949e+00 cm⁻³.

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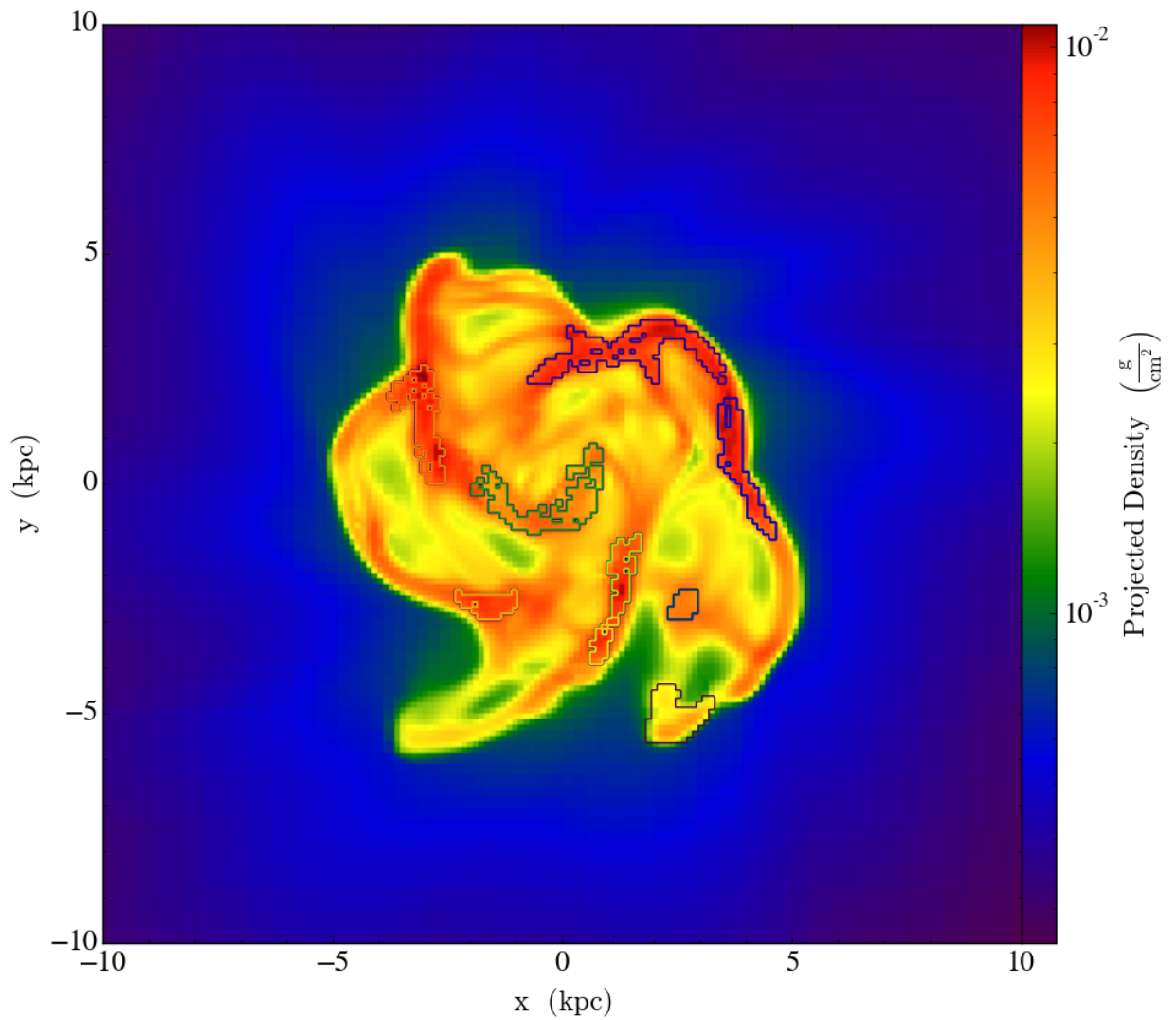
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Get a list of the leaf clumps and display them in a projection.

```
In [14]: leaf_clumps = get_lowest_clumps(master_clump)
prj = yt.ProjectionPlot(ds, 2, field, center='c', width=(20,'kpc'))
prj.annotate_clumps(leaf_clumps)
prj.show()
```



In []: