JupyterLab: The Evolution of the Jupyter Notebook

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The Jupyter Notebook

Jupyter Notebook

Interactive, Exploratory, Reproducible

- Interactive, browser-based computing environment
- Exploratory data science, ML, visualization, analysis, stats
- Reproducible document format:
  - Code
  - Narrative text (markdown)
  - Equations (LaTeX)
  - Images, visualizations
- Over 100 programming languages
- Everything open-source (BSD license)

Jupyter Notebook

A Jupyter Notebook document with a visualization of measles data.

Building Blocks for Interactive Computing

Building Blocks

File Browser

Notebooks

Terminal

Text Editor

Kernels

Output

Introducing JupyterLab

JupyterLab: Integrated Experience

File Edit View Run Kernel Tabs Settings Help

Files | Running | Commands | Cell Tools | Tabs

Lorenz.ipynb

Code | Python 3

We explore the Lorenz system of differential equations:

$$\dot{x} = \sigma(y - x)$$
$$\dot{y} = \rho x - y - xz$$
$$\dot{z} = -\beta z + xy$$

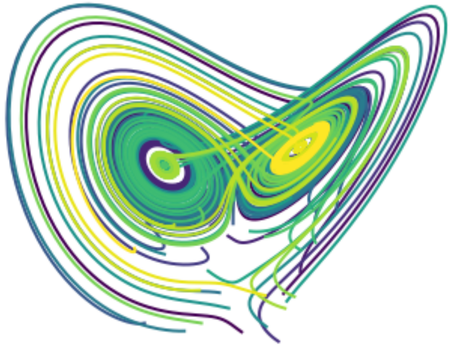
Let's change (σ, β, ρ) with ipywidgets and examine the trajectories.

In [2]:
```
from lorenz import solve_lorenz
w=interactive(solve_lorenz,sigma=(0.0,50.0),rho=(0.0,50.0))
w
```

sigma 10.00

beta 2.67

rho 28.00



lorenz.py

```
def solve_lorenz(sigma=10.0, beta=8./3, rho=28.0):
    """Plot a solution to the Lorenz differential equations."""

    max_time = 4.0
    N = 30

    fig = plt.figure()
    ax = fig.add_axes([0, 0, 1, 1], projection='3d')
    ax.axis('off')

    # prepare the axes limits
    ax.set_xlim((-25, 25))
    ax.set_ylim((-35, 35))
    ax.set_zlim((5, 55))

    def lorenz_deriv(x_y_z, t0, sigma=sigma, beta=beta, rho=rho):
        """Compute the time-derivative of a Lorenz system."""
        x, y, z = x_y_z
        return [sigma * (y - x), x * (rho - z) - y, x * y - beta * z]

    # Choose random starting points, uniformly distributed from -15 to 15
    np.random.seed(1)
    x0 = -15 + 30 * np.random.random((N, 3))

    # Solve for the trajectories
    t = np.linspace(0, max_time, int(250*max_time))
    x_t = np.asarray([integrate.odeint(lorenz_deriv, x0i, t)
                      for x0i in x0])

    # choose a different color for each trajectory
    colors = plt.cm.viridis(np.linspace(0, 1, N))

    for i in range(N):
        x, y, z = x_t[i,:,:].T
        lines = ax.plot(x, y, z, '-', c=colors[i])
        plt.setp(lines, linewidth=2)
    angle = 104
    ax.view_init(30, angle)
```

JupyterLab

Building Blocks

- Work with the building blocks in a flexible and integrated manner
- Modern JavaScript development: npm-based packaging, Typescript, phosphor.js
- Clean model/view separation
- Well-separated public/private APIs
- Fully extensible by third parties
- High performance
- Design!

July 2019

JupyterLab Today

- https://github.com/jupyterlab
- ~5 years worth of development
- ~250 contributors, ~70 components
- ~5,600 releases (npm+python)
- ~16,000 commits, ~classic notebook
- Currently 1.0, ready for use

Roadmap

JupyterLab 1.0: Use It Today

conda install -c conda-forge jupyterlab
or pip install jupyterlab

- Eventually:
  - Classic notebook will be retired

Live Demos!