

## GlowScript VPython

- No installation nor file manipulations
- Runs in a browser
- Easily usable by programming novices
- Navigable 3D animations as a side effect
- Programs exportable to own web page
- Compiles Python to JavaScript in the browser; uses the RapydScript transpiler
- Exploits the modern GPU (Graphics Processing Unit): rich graphics, including pixel-level transparency and rapidly displayable compound objects
- New commands to attach trails or arrows to moving objects
- Free, open source, runs on all platforms
- Runs on phones and tablets – try it!

[tinyurl.com/VPorbit](http://tinyurl.com/VPorbit)

Then click “Edit this program” to see the very short program code

Use GlowScript VPython at [glowsript.org](http://glowsript.org)

The Jupyter notebook environment is increasingly popular with computational physicists. A browser displays the notebook, which contains cells that can contain not only program code but also text, LaTeX equations, and images. Python programs have full access to the many scientific modules available for Python, such as numpy, scipy, etc. Jupyter notebook capability and a large suite of scientific modules are included when you install the Anaconda or Canopy Python distributions. The professional nature of the Jupyter notebook makes it an appropriate environment for students in upper-level computational physics courses.

## The Jupyter Notebook

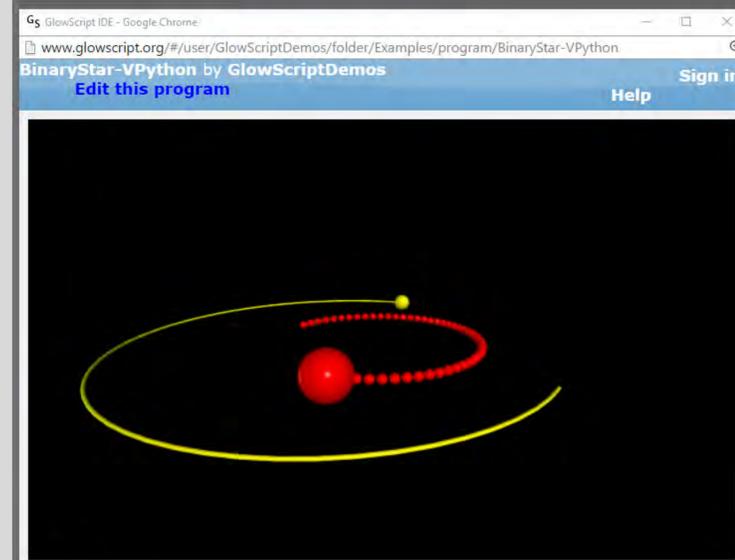
## Jupyter VPython

VPython is now available in a Jupyter notebook. It uses the same syntax as GlowScript VPython. VPython animations are displayed in the notebook, using the GlowScript graphics library.

Install Anaconda or Canopy Python, then install Jupyter VPython by executing in a terminal “pip install vpython”. See [vpython.org](http://vpython.org) for more details. Jupyter VPython is free, open source, and runs on all platforms.

```

1 # GlowScript 2.1 VPython
2 scene.caption = """In GlowScript programs:
3 Right button drag or Ctrl-drag to rotate "camera" to view scene.
4 To zoom, drag with middle button or Alt/Option depressed, or use scroll wheel.
5 On a two-button mouse, middle is left + right.
6 Touch screen: pinch/extend to zoom, swipe or two-finger rotate."""
7 scene.forward = vector(0,-.3,-1)
8
9 G = 6.7e-11 # Newton gravitational constant
10
11 giant = sphere(pos=vector(-1e11,0,0), radius=2e10, color=color.red,
12               make_trail=True, trail_type='points', interval=10, retain=50)
13 giant.mass = 2e30
14 giant.p = vector(0, 0, -1e4) * giant.mass
15
16 dwarf = sphere(pos=vector(1.5e11,0,0), radius=1e10, color=color.yellow,
17               make_trail=True, interval=10, retain=50)
18 dwarf.mass = 1e30
19 dwarf.p = -giant.p
20
21 dt = 1e5
22 while True:
23     rate(200)
24     r = dwarf.pos - giant.pos
25     F = G * giant.mass * dwarf.mass * norm(r) / mag2(r)
26     giant.p = giant.p + F*dt
27     dwarf.p = dwarf.p - F*dt
28     giant.pos = giant.pos + (giant.p/giant.mass) * dt
29     dwarf.pos = dwarf.pos + (dwarf.p/dwarf.mass) * dt
    
```



In GlowScript programs:  
 Right button drag or Ctrl-drag to rotate "camera" to view scene.  
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 On a two-button mouse, middle is left + right.  
 Touch screen: pinch/extend to zoom, swipe or two-finger rotate.

Jupyter notebook

Text cell  
 Program cell

VPython animation  
 (Student program)

VPython graph

Additional program cell

Many physics demo programs written in GlowScript VPython are available at [matterandinteractions/student](http://matterandinteractions/student)

**Classic VPython**  
 Classic VPython is still available but is not being developed further, due to the need to exploit the GPU and to difficulties of supporting installation on an increasingly large range of platforms. For more details on the issues, see [vpython.org/contents/announcements/evolution.html](http://vpython.org/contents/announcements/evolution.html)

