VPython - symulacje fizyczne z grafiką 3D dla każdego

wykład 11

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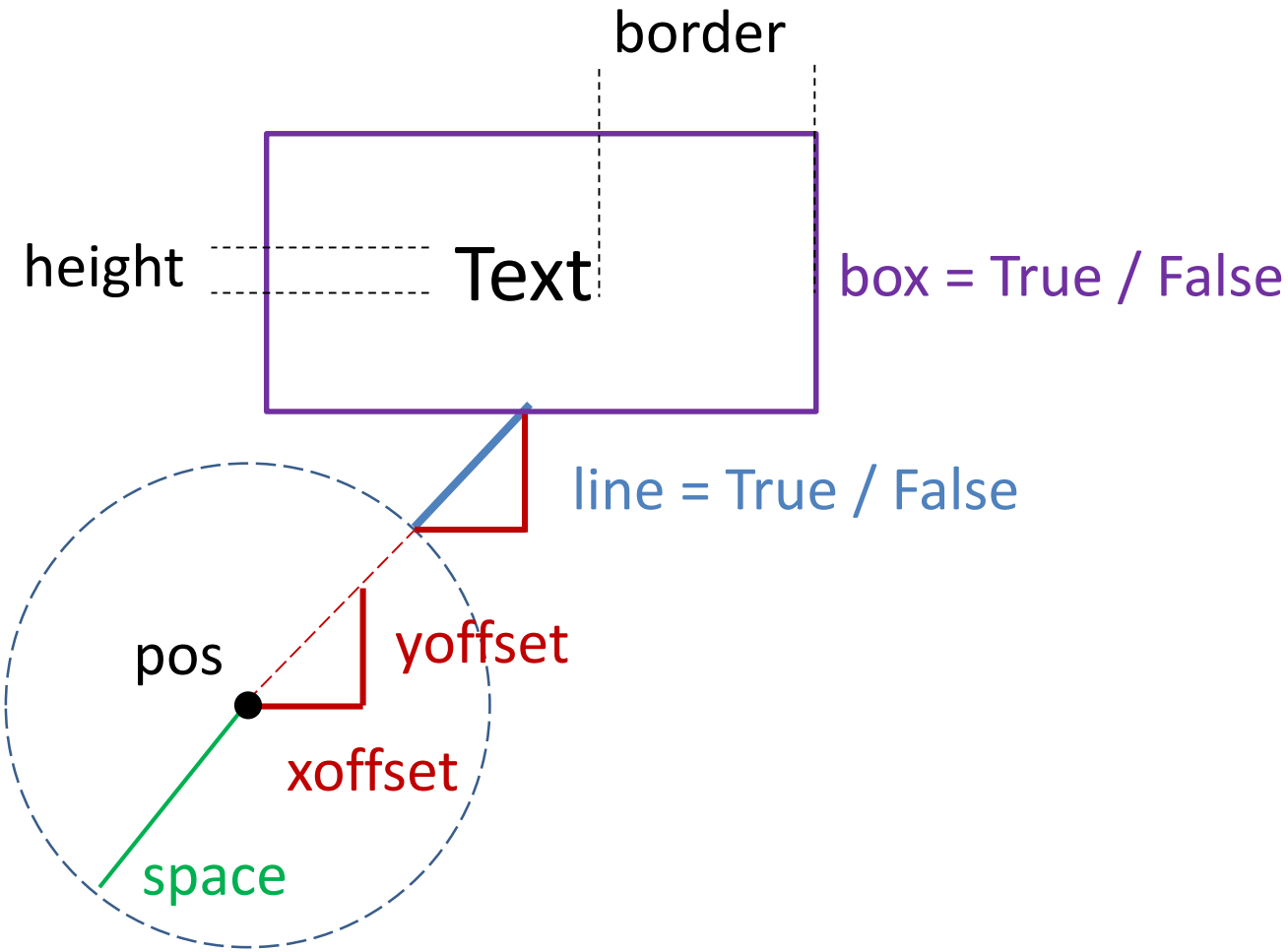
napis (label)


border
height
Text
box = True / False
line = True / False
pos
yoffset
xoffset
space

label

vp_label_1.py - C:\Users\Wysokie Energie\Desktop\VPython\lec_a_11\vp_label_1.py

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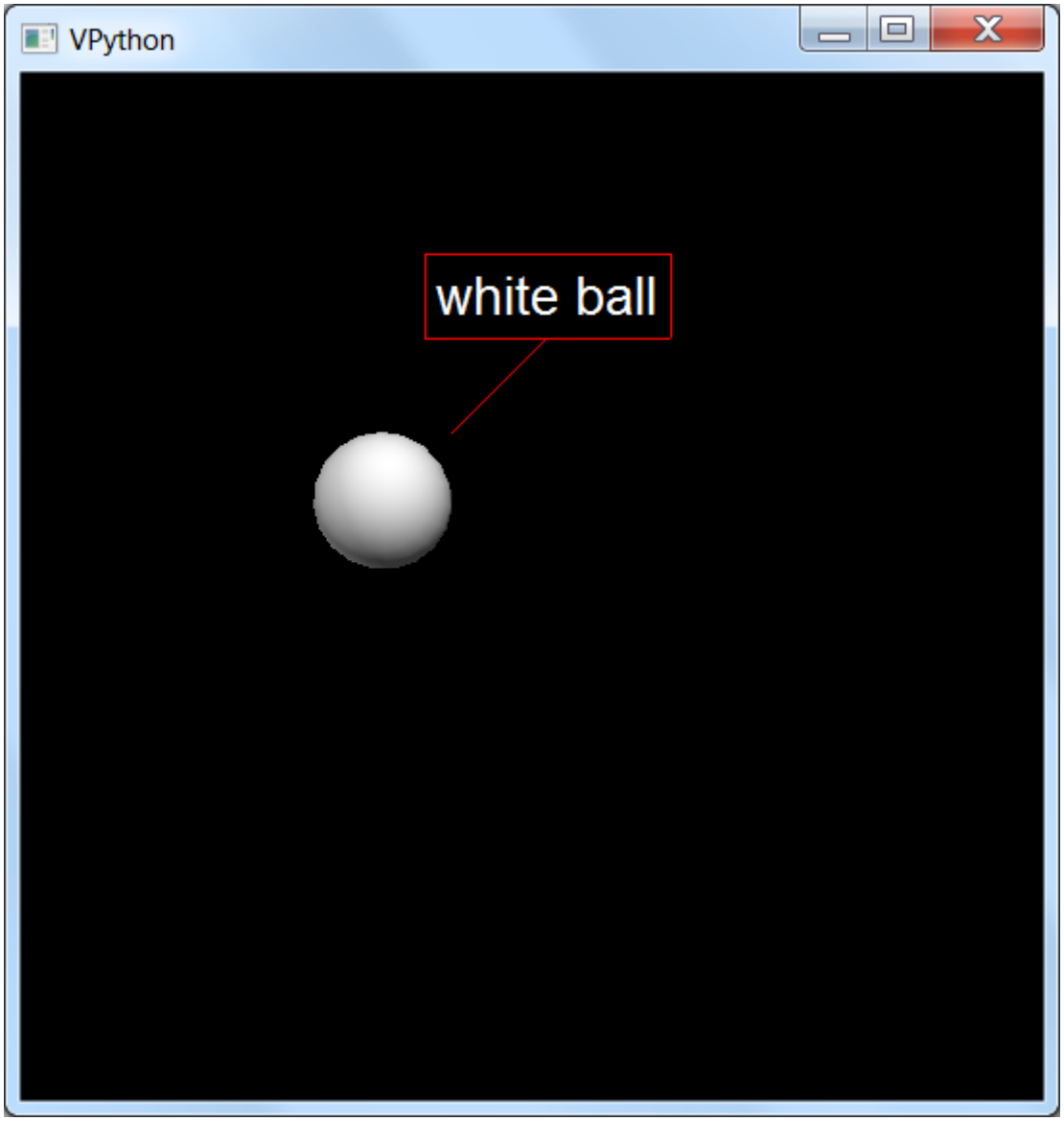
```
from visual import *

scene = display(width=550, height=580, range=3)

ball = sphere(pos=(0,1,0), radius=0.4)

txt = label(pos=ball.pos, space=50, xoffset=50, yoffset=50,
            text='white ball', height=20, color=color.white,
            linecolor=color.red)
t = 0
while 1:
    rate(1000)
    ball.pos = (sin(t), cos(t), 0)
    txt.pos = ball.pos
    t += 0.001
```

Ln: 17 Col: 0

liczby w pikselach


VPython
white ball

piramida (pyramid)

vp_pyramid.py - C:\Users\Wysokie Energie\Desktop\VPython\lec_a_11\vp_pyramid.py

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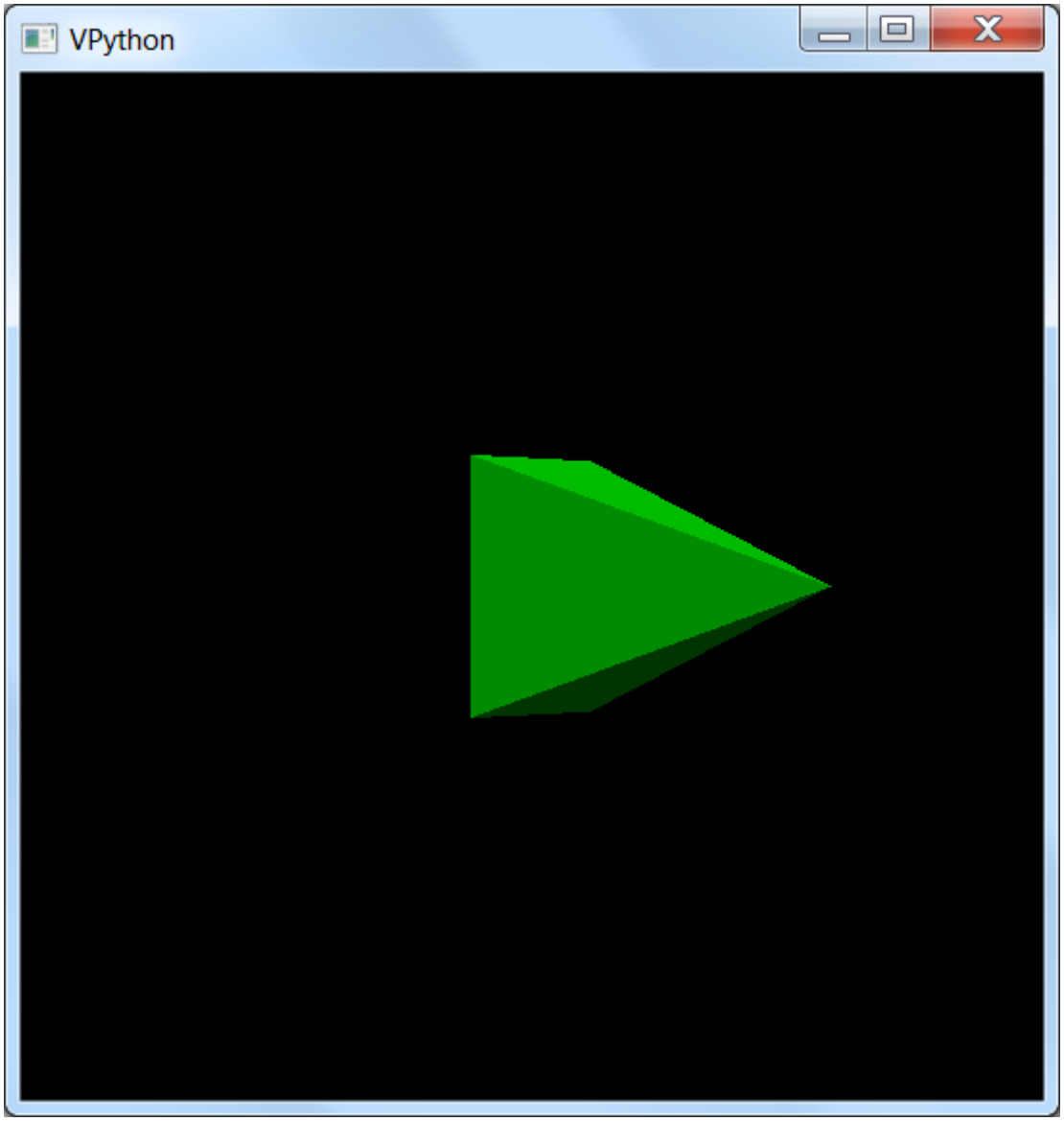
```
from visual import *

scene = display(width=550, height=580, range=8)

pyr = pyramid(pos=(0,0,0), size=(7,4,2), axis=(1,0,0),
              color=color.green)

sleep(2)

t = 0
while 1:
    rate(1000)
    pyr.axis = 7*vector(cos(t),0,-sin(t))
    t += 0.001
```

Ln: 16 Col: 0

pos – środek prostokątnej podstawy

size - rozmiar w (x, y, z) jeśli axis = (1,0,0)

długość axis = rozmiar w x jeśli piramida jest skierowana do (1,0,0)


VPython

stożek (cone)

vp_cone.py - C:\Users\Wysokie Energie\Desktop\VPython\lec_a_11\vp_cone.py

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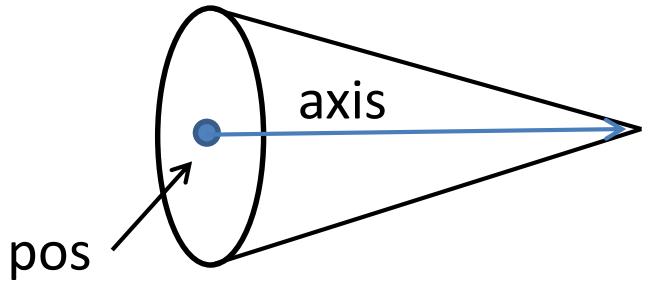
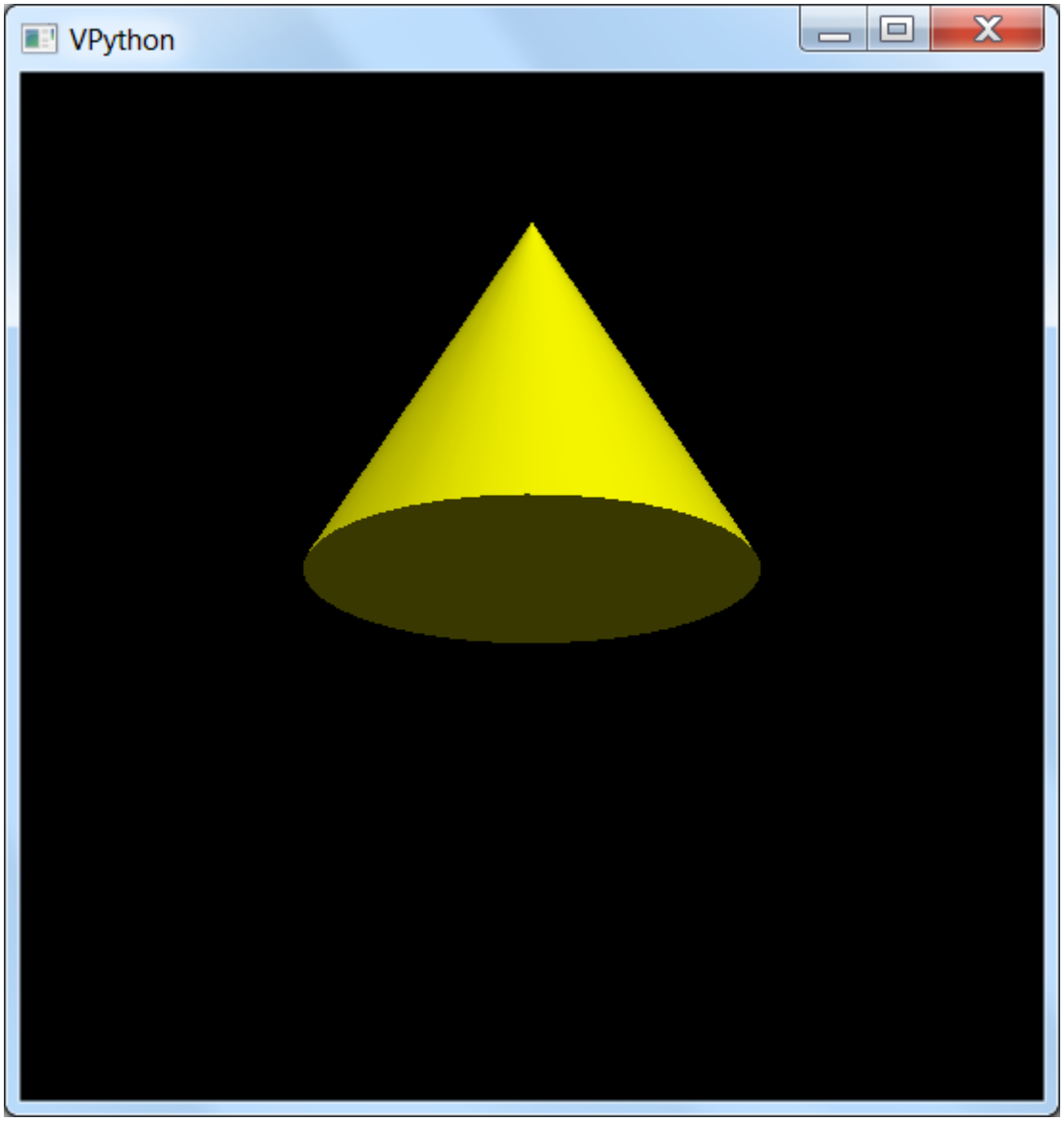
```
from visual import *

scene = display(width=550, height=580)

co = cone(pos=(0,0,0), axis=(0,6,-2), length=6,
          radius=3, color=color.yellow)
```

Ln: 9 Col: 0

pos – środek podstawy




VPython

elipsoida (ellipsoid)

vp_ellip.py - C:\Users\Wysokie Energie\Desktop\VPython\lec_a_11\vp_ellip.py

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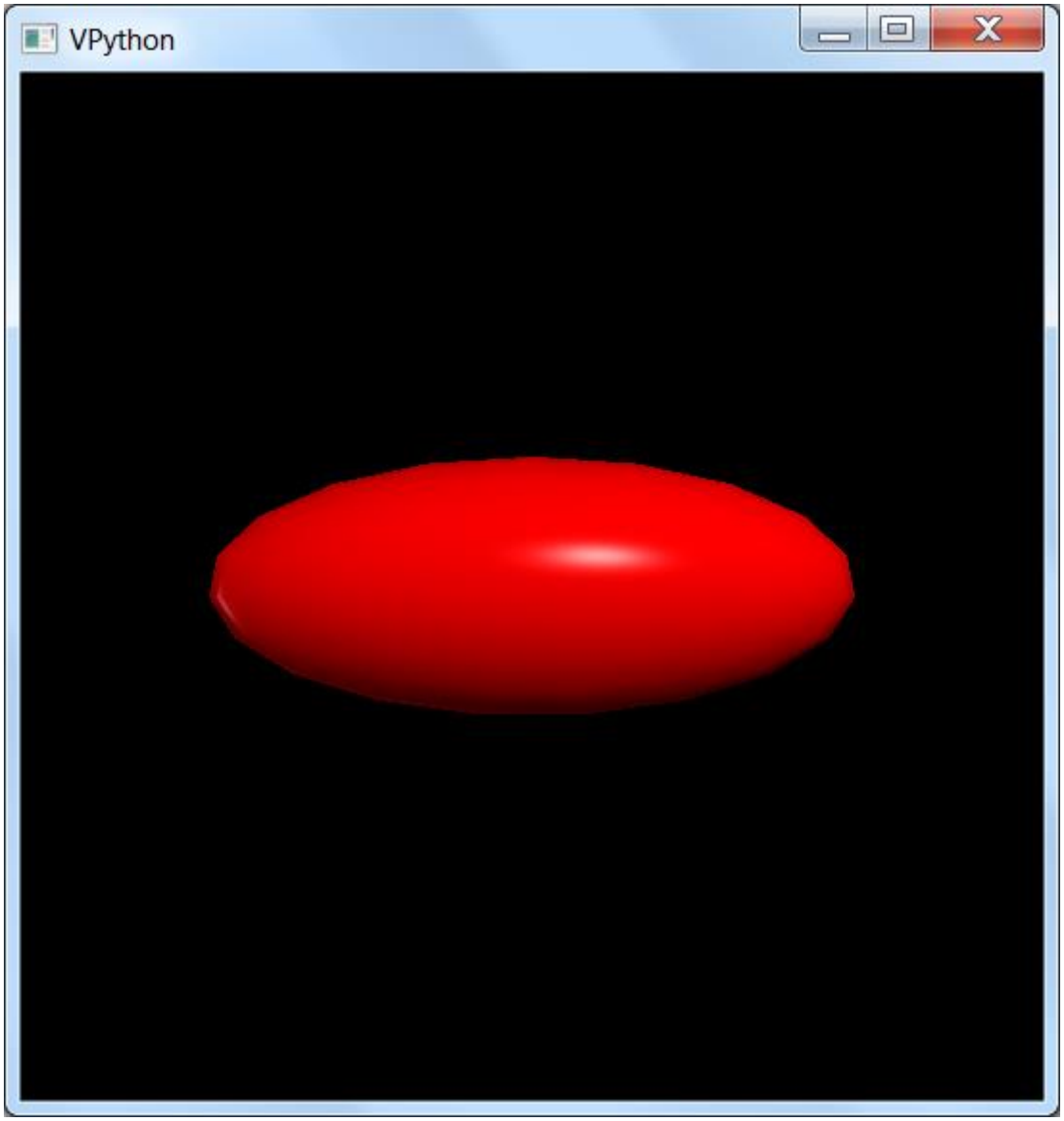
```
from visual import *

scene = display(width=550, height=580, range=10)

eli = ellipsoid(pos=(0,0,0), axis=(1,0,0), size=(5,5,5),
                material=materials.plastic, color=color.red)

t = 0
while 1:
    rate(100)
    eli.size = (5+t, 5, 5)
    t += 0.01
```

Ln: 14 Col: 0

pos – środek elipsoidy

size - rozmiar w (x, y, z) jeśli axis = (1,0,0)


VPython

strzałka (arrow)

vp_arrow.py - C:\Users\Wysokie Energie\Desktop\VPython\lec_a_11\vp_arrow.py

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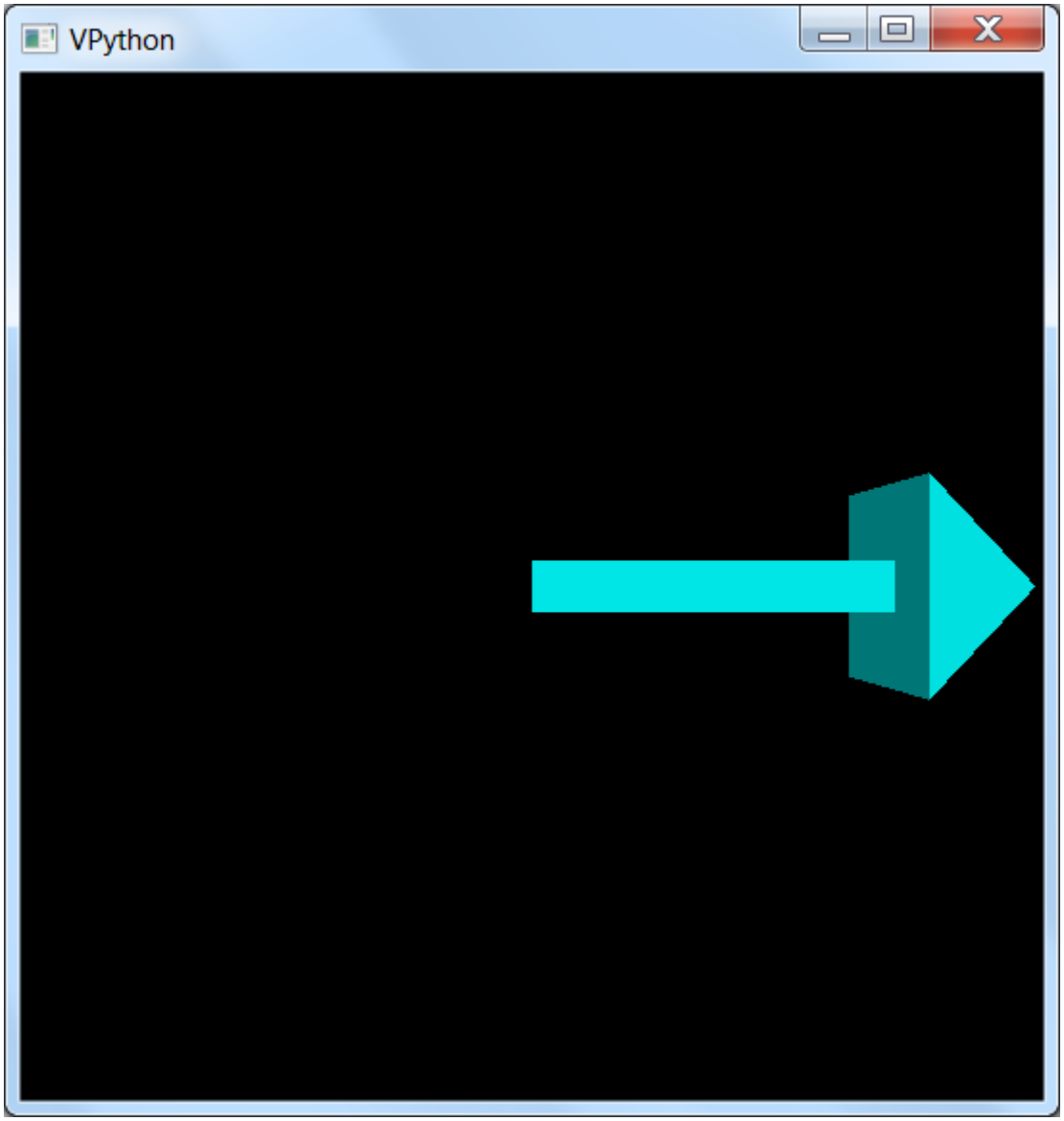
```
from visual import *

scene = display(width=550, height=580)

ar = arrow(pos=(0,0,0), axis=(1,0,0), length=5,
           color=color.cyan)

sleep(2)

ar.headwidth = 2
```

Ln: 12 Col: 0

Proszę pobawić się z shaftwidth, headlength

Domyślnie:
shaftwidth = 0.1*(length of arrow)
headwidth = 2*shaftwidth
headlength = 3*shaftwidth


VPython

arrow

vp_arrow_2.py - C:\Users\Wysokie Energie\Desktop\VPython\lec_a_11\vp_arrow_2.py

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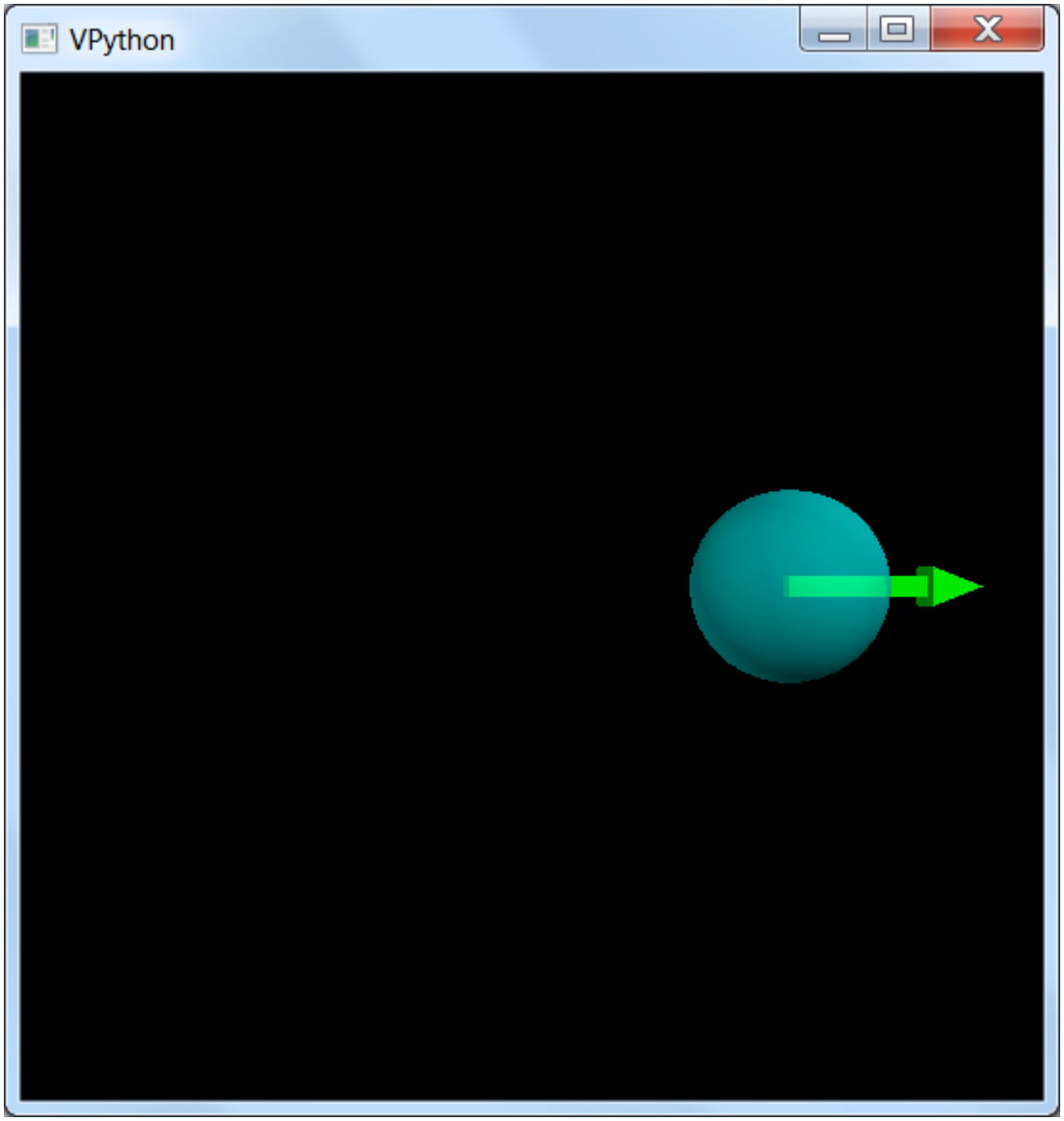
```
from visual import *

scene = display(width=550, height=580, range=8)

ba = sphere(pos=(0,0,0), radius=1.5, color=color.cyan,
            opacity=0.6)
ba.v = vector(5,0,0)

ar = arrow(pos=ba.pos, axis=ba.v, color=color.green)

t = 0
dt = 0.001
while 1:
    rate(1000)
    ba.v = vector(5*cos(t),0,0)
    ba.pos += ba.v*dt
    ar.pos = ba.pos
    ar.axis = ba.v
    t += dt
```

Ln: 21 Col: 0


VPython

ring

vp_ring.py - C:\Users\Wysokie Energie\Desktop\VPython\lec_a_11\vp_ring.py

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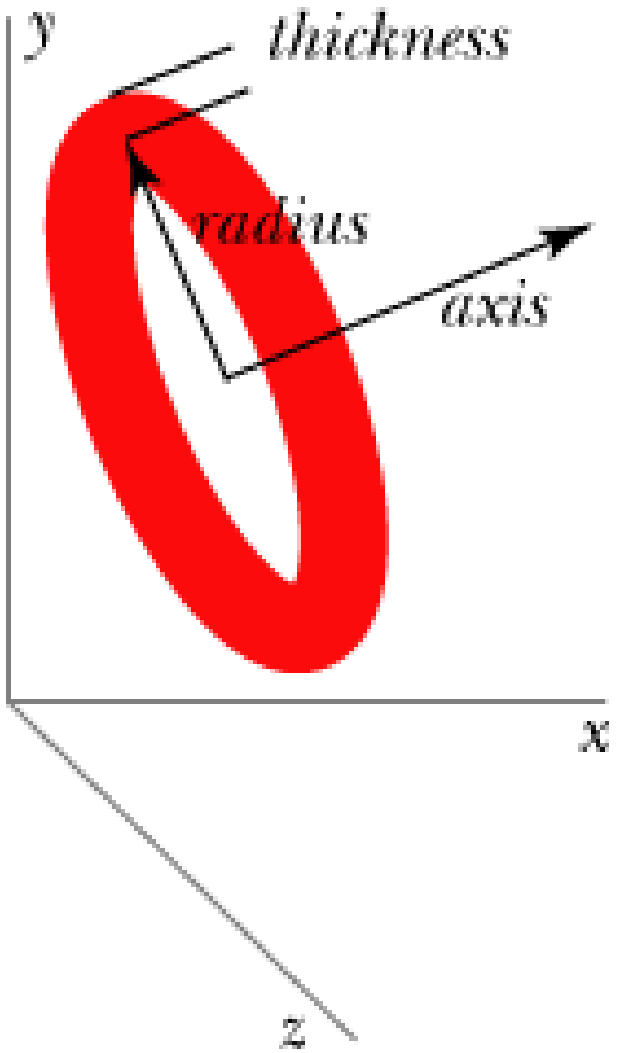
```
from visual import *

scene = display(width=550, height=580, range=3)

ri = ring(pos=(0,0,0), axis=(1,0,0), radius=1.5,
          thickness=0.3, color=color.cyan)

t = 0
dt = 0.01
while 1:
    rate(500)
    ri.axis = (cos(t), -1+exp(0.06*t), sin(t))
    t += dt
```

Ln: 15 Col: 0

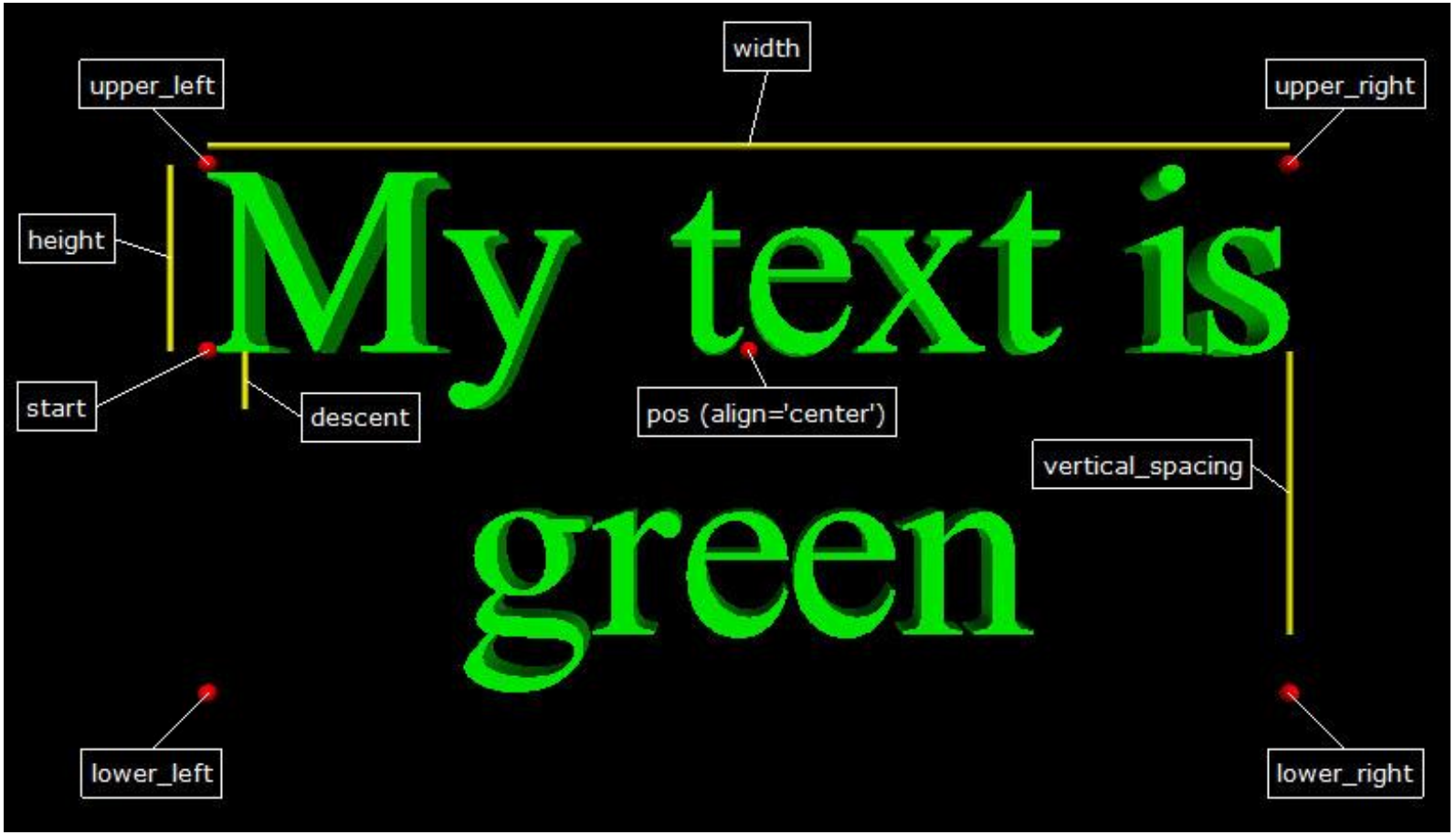
ring



długość axis jest bez znaczenia


VPython

napis 3D


width
upper_left
upper_right
height
My text is
green
start
descent
pos (align='center')
vertical_spacing
lower_left
lower_right

napis 3D

vp_text.py - C:\Users\Wysokie Energie\Desktop\VPython\lec_a_11\vp_text.py

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```
from visual import *

scena = display(width=550, height=580)

tt = text(pos=(0,0,0), text='some \ntext', height=2,
          align='center', depth=+10, color=color.red,
          font='Times', material=materials.wood)
```

Ln: 10 Col: 0

align='center'/ 'right' / 'left'
depth > 0, w kierunku od ekranu
depth < 0, w kierunku za ekran
font = 'sans' / 'serif' / 'monospace' ...


VPython
some
text

3D text, axis

vp_text_2.py - C:\Users\Wysokie Energie\Desktop\VPython\lec_a_11\vp_text_2.py

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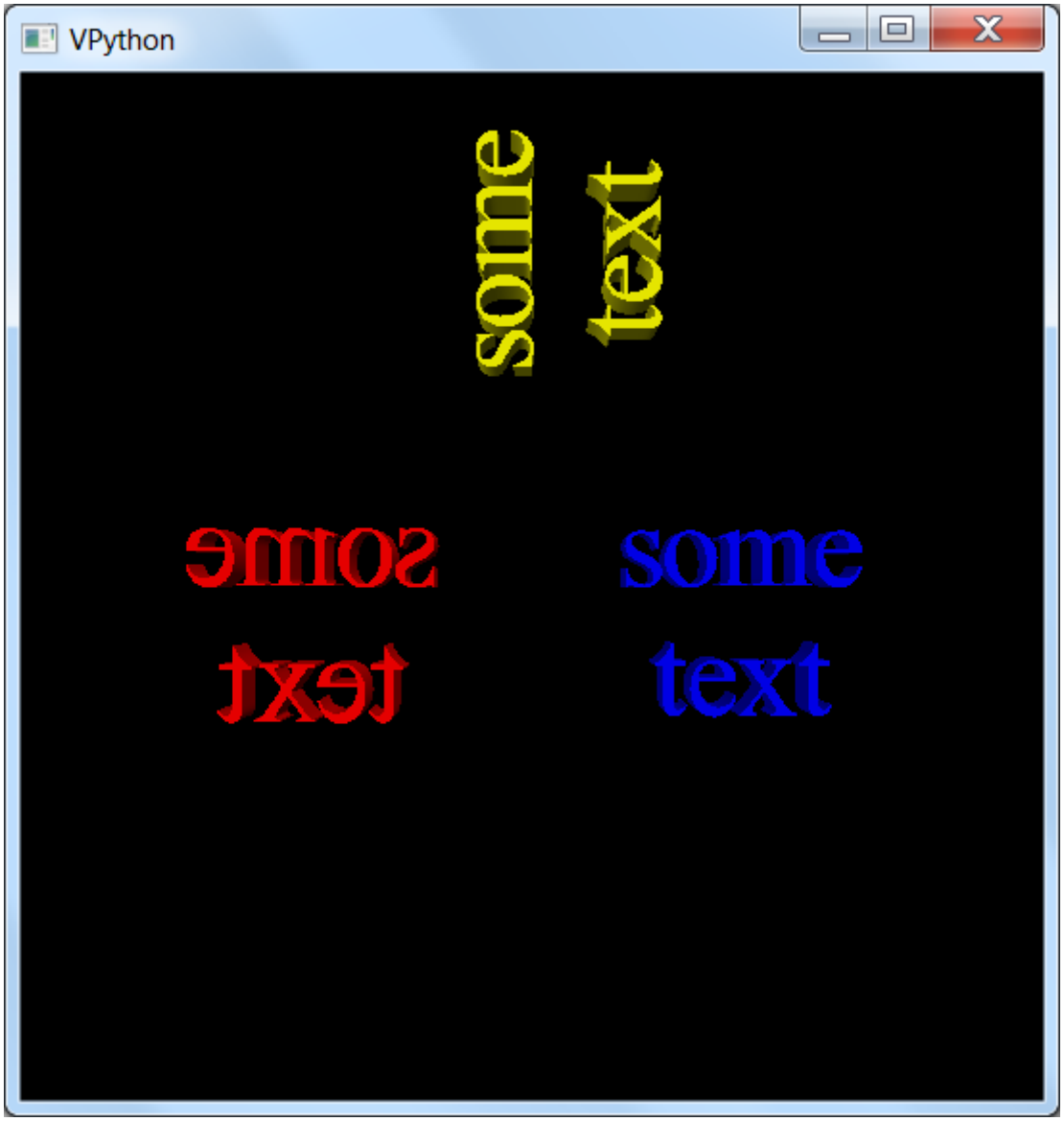
```
from visual import *

scene = display(width=550, height=580)

tt1 = text(pos=(-5,0,0), text='some \ntext', height=2,
           align='center', depth=-1, color=color.red,
           axis=(-1,0,0))

tt2 = text(pos=(5,0,0), text='some \ntext', height=2,
           align='center', depth=-1, color=color.blue,
           axis=(1,0,0))

tt3 = text(pos=(0,8,0), text='some \ntext', height=2,
           align='center', depth=-1, color=color.yellow,
           axis=(0,1,0))
```

Ln: 17 Col: 0


VPython
some
text
some
text
some
text

światło lokalne (local_light)

vp_light.py - C:\Users\Wysokie Energie\Desktop\VPython\lec_a_11\vp_light.py

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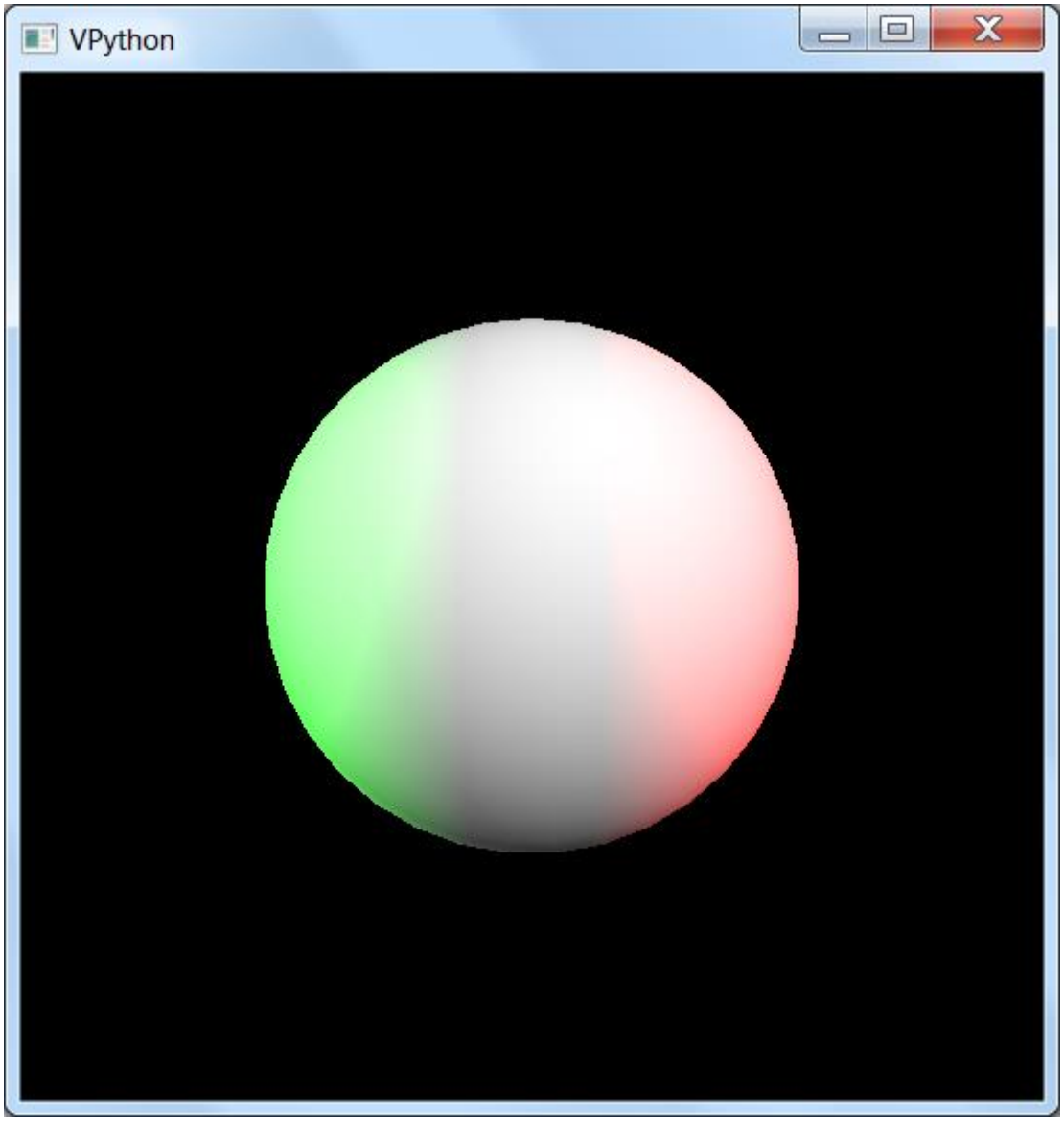
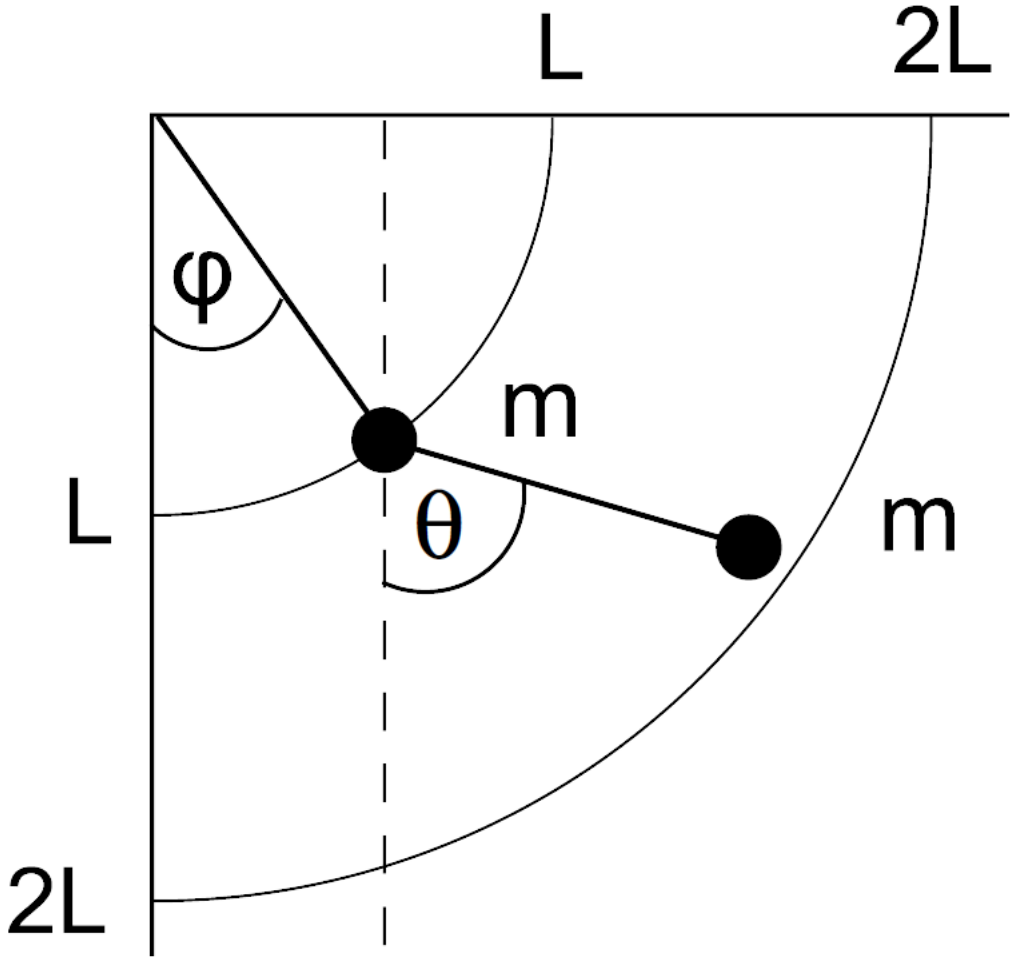
```
from visual import *

scene = display(width=550, height=580, range=2)

ball = sphere()

light1 = local_light(pos=(5,0,0), color=color.red)

light2 = local_light(pos=(-5,0,0), color=color.green)
```

Ln: 11 Col: 0


VPython

Podwójne wahadło i chaos



Równania ruchu

$$\ddot{\varphi}\left[1+\sin^2(\varphi-\theta)\right] = -\frac{g}{L}\left(2\sin(\varphi)-\sin(\theta)\cos(\varphi-\theta)\right) - \frac{1}{2}\dot{\varphi}^2\sin(2\varphi-2\theta) - \dot{\theta}^2\sin(\varphi-\theta),$$

$$\ddot{\theta}\left[1+\sin^2(\varphi-\theta)\right] = -\frac{g}{L}\left(2\sin(\theta)-2\sin(\varphi)\cos(\varphi-\theta)\right) + \frac{1}{2}\dot{\theta}^2\sin(2\varphi-2\theta) + 2\dot{\varphi}^2\sin(\varphi-\theta).$$

Warunki początkowe

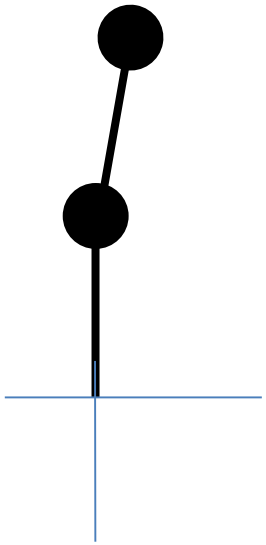
$t = 0$

$\varphi = \pi,$ początkowa pozycja

$\theta = \pi - 0.1,$ początkowa pozycja

$\dot{\varphi} = 0,$ początkowa prędkość kątowa

$\dot{\theta} = 0,$ początkowa prędkość kątowa



$$\ddot{\varphi}\left[1+\sin^2(\varphi-\theta)\right] = -\frac{g}{L}\left(2\sin(\varphi)-\sin(\theta)\cos(\varphi-\theta)\right) - \frac{1}{2}\dot{\varphi}^2\sin(2\varphi-2\theta) - \dot{\theta}^2\sin(\varphi-\theta),$$

$$\ddot{\theta}\left[1+\sin^2(\varphi-\theta)\right] = -\frac{g}{L}\left(2\sin(\theta)-2\sin(\varphi)\cos(\varphi-\theta)\right) + \frac{1}{2}\dot{\theta}^2\sin(2\varphi-2\theta) + 2\dot{\varphi}^2\sin(\varphi-\theta).$$

Liczymy $\ddot{\varphi}$ i $\ddot{\theta}$ (przyśpieszenia kątowe) z powyższych równań
i następnie
$\dot{\varphi} = \dot{\varphi} + \ddot{\varphi} \cdot dt$
$\dot{\theta} = \dot{\theta} + \ddot{\theta} \cdot dt$
i następnie
$\varphi = \varphi + \dot{\varphi} \cdot dt$
$\theta = \theta + \dot{\theta} \cdot dt$

dt jak najmniejsze
rate() jak największe