This is an example session showing the interactive use of the WaveBlocks simulation packet.

In [2]:
```
from WaveBlocks import *
```

Some simulation parameters:

In [3]:
```
params = {"eps":0.1, "ncomponents":1, "potential":"quadratic", "dt":0.1, "matrix_exponential":"pade"}
```

Create a Hagedorn wavepacket Ψ

In [4]:
```
Phi = HagedornWavepacket(params)
```

Assign the parameter set Π with position 1.0 and momentum 0.5

In [5]:
```
Pi = Phi.get_parameters()
Pi
```

Out[5]:
```
(1j, 1.0, 0.0, 0.0, 0.0)
```

In [6]:
```
Pi = list(Pi)
Pi[3] = 0.5
Pi[4] = 1.0
Pi
```

Out[6]:
```
[1j, 1.0, 0.0, 0.5, 1.0]
```

In [7]:
```
Phi.set_parameters(Pi)
```

Set the coefficients such that we start with a ϕ_1 packet

In [8]:
```
Phi.set_coefficient(0,1,1)
```

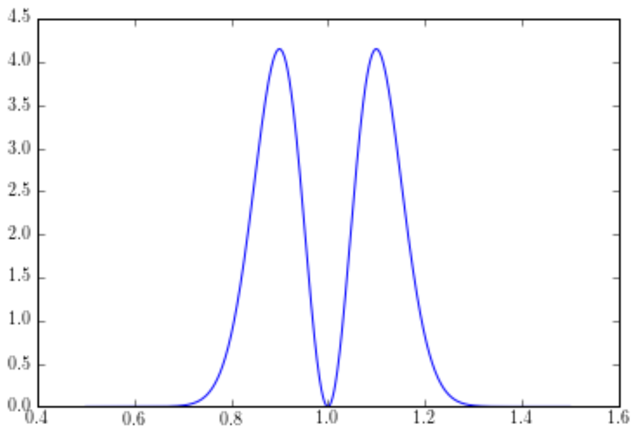
Plot the initial configuration

In [9]:
```
x = linspace(0.5,1.5,1000)
```

In [10]:
```
y = Phi.evaluate_at(x, prefactor=True)[0]
```

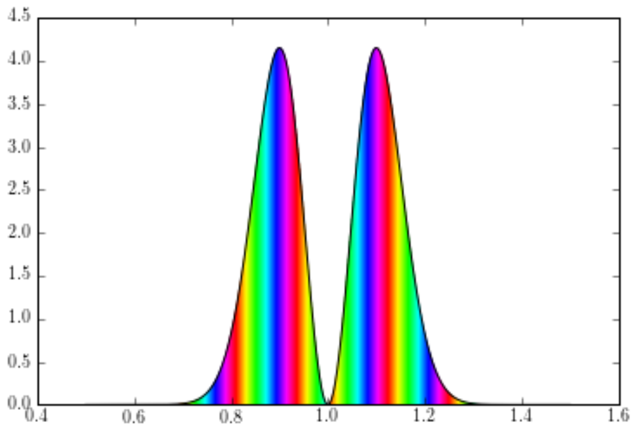
In [11]:
```
plot(x, abs(y)**2)
```

Out[11]:
```
[Line2D(_line0)]
```



In [12]:
```
from WaveBlocks.Plot import plotcf, stemcf
```

In [13]:
```
plotcf(x, angle(y), abs(y)**2)
```

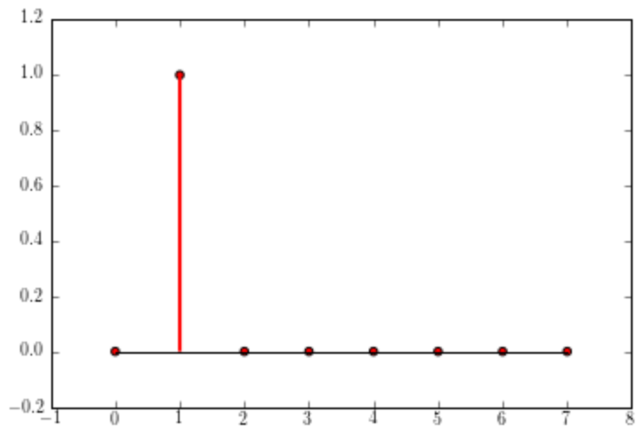


In [14]:
```
c = Phi.get_coefficients(component=0)
c = squeeze(c)
```

In [15]:
```
c.shape
```

Out[15]: (8,)

In [16]:
```
figure(figsize(6,4))
stemcf(arange(c.shape[0]), angle(c), abs(c)**2)
```



Set up the potential $V(x)$ for our simulation. We use a simple harmonic oscillator.

In [17]:
```
V = PotentialFactory.create_potential(params)
```

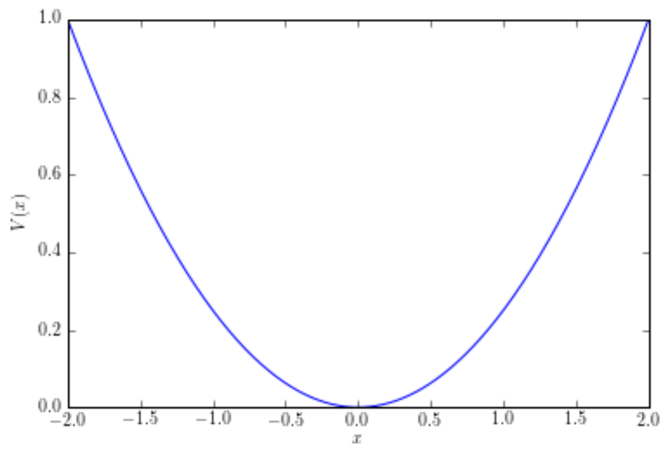
In [18]:
```
V.potential
```

Out[18]: $\frac{1}{4}x^2$

In [19]:
```
u = linspace(-2,2,1000)
v = V.evaluate_at(u)[0]
```

In [20]:
```
plot(u,v)
xlabel(r"$x$")
ylabel(r"$V(x)$")
```

Out[20]: Text(0,0.5,'$V(x)$')



Don't forget to set up the quadratur rule (γ, ω)

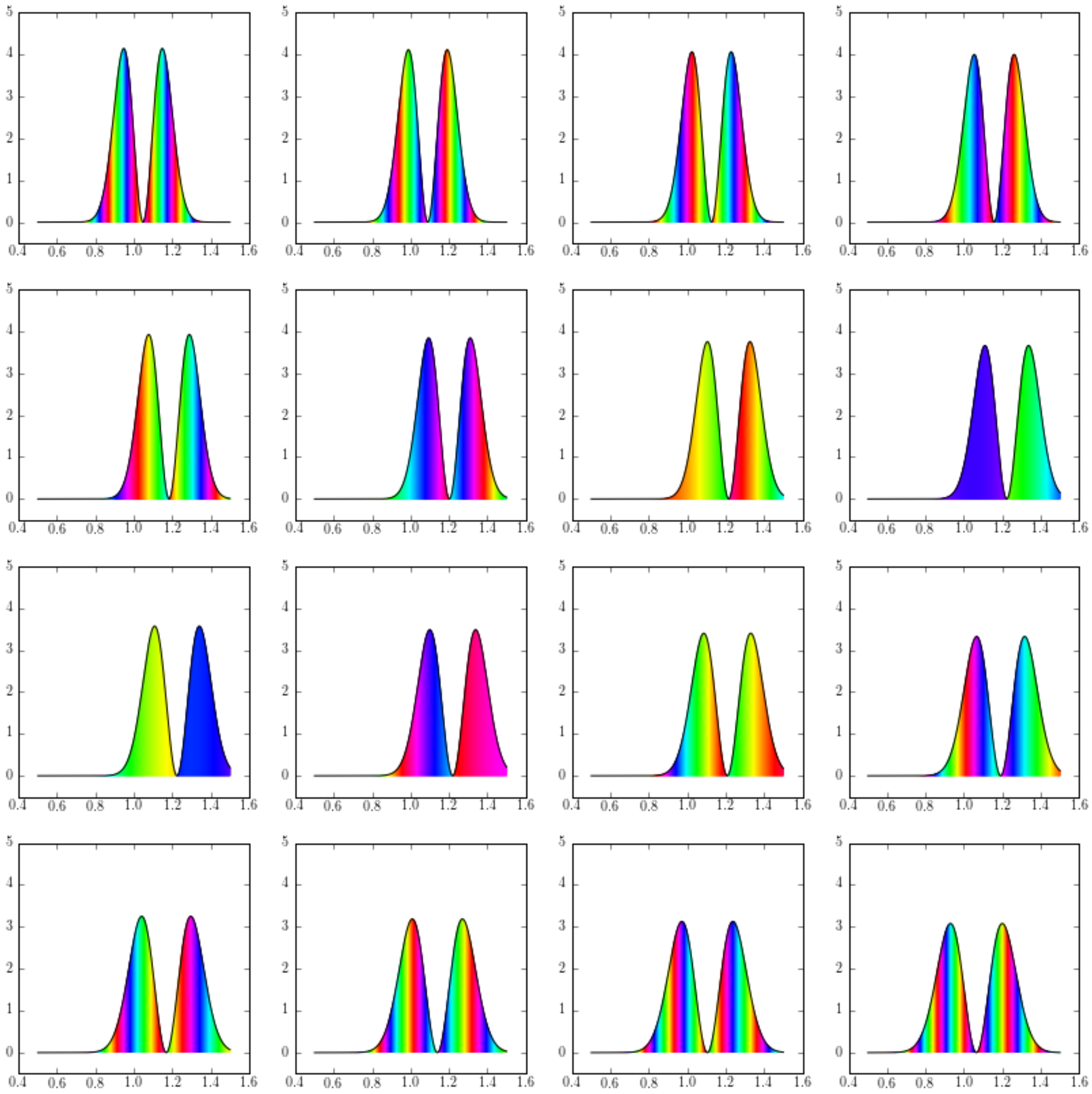
In [21]:
```
Phi.set_quadrature(None)
```

Now construct the time propagator

In [22]:
```
P = HagedornPropagator(V, Phi, 0, params)
```

Propagate for 16 timesteps and plot each state

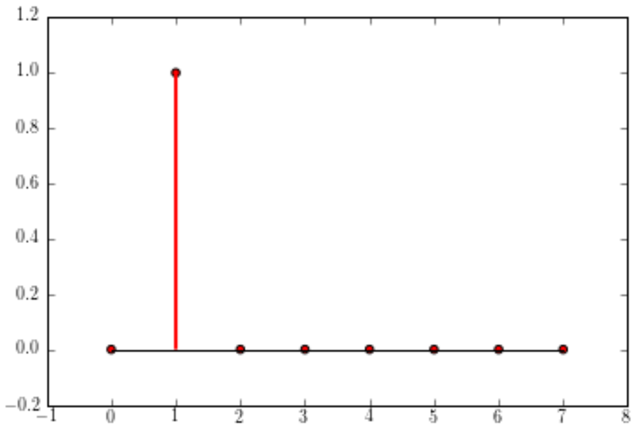
In [23]:
```
fig = figure(figsize(14,14))

for i in xrange(16):
    P.propagate()
    ynew = P.get_wavepackets().evaluate_at(x, prefactor=True)[0]
    ax = subplot(4,4,i+1)
    plotcf(x, angle(ynew), abs(ynew)**2, axes=ax)
    ax.set_ylim((-0.5, 5))
```



Look at the coefficients c again

In [24]:
```
cnew = Phi.get_coefficients(component=0)
cnew = squeeze(cnew)
```

In [25]:
```
figure(figsize(6,4))
stemcf(arange(8), angle(cnew), abs(c)**2)
```



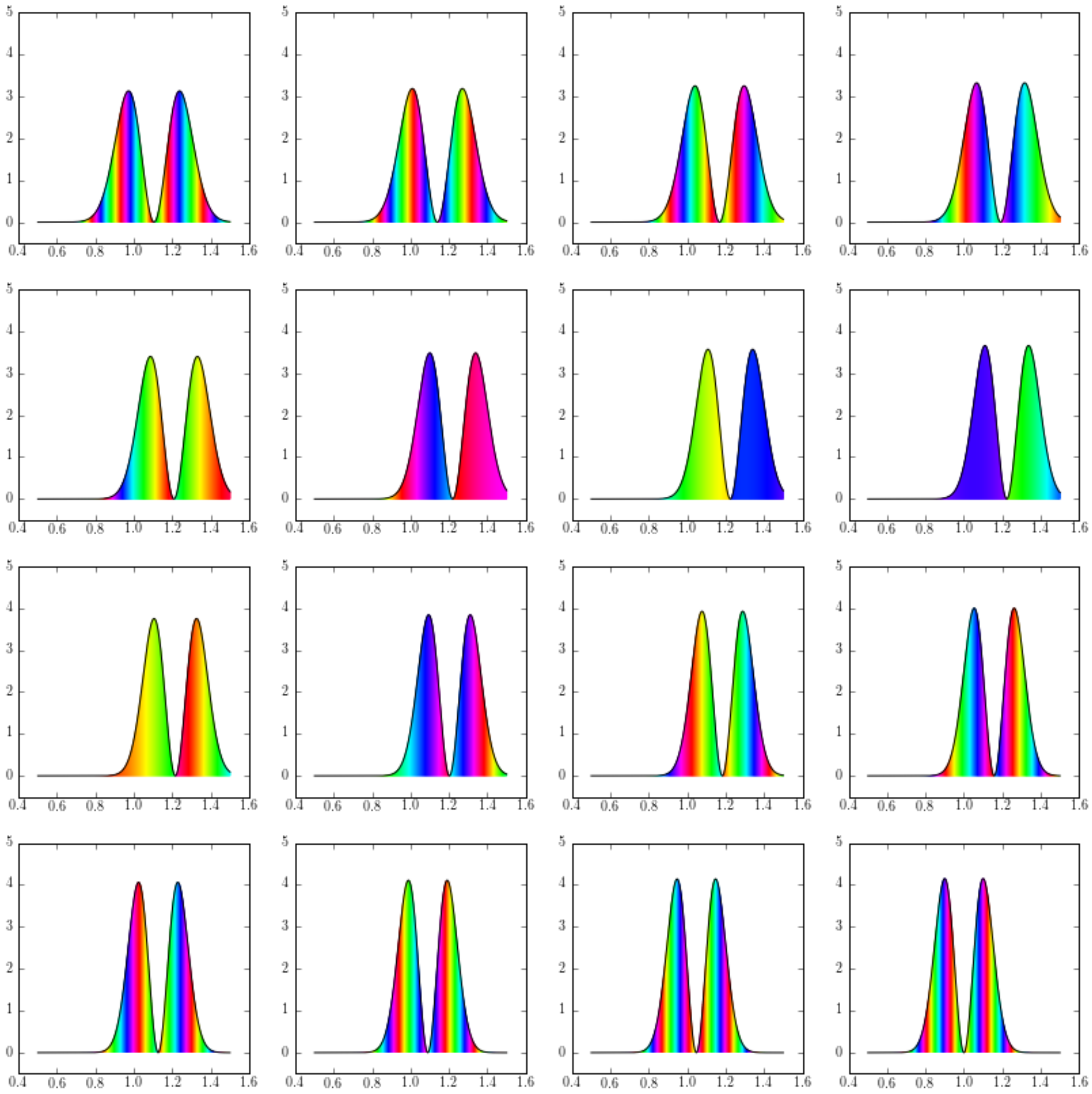
We see that the packet Ψ is still a ϕ_1

Now we go back in time ...

In [26]:
```
params["dt"] *= -1
```

In [27]:
```
Pinv = HagedornPropagator(V, Phi, 0, params)
```

In [28]:
```
fig = figure(figsize(14,14))

for i in xrange(16):
    Pinv.propagate()
    ynew = Pinv.get_wavepackets().evaluate_at(x, prefactor=True)[0]
    ax = subplot(4,4,i+1)
    plotcf(x, angle(ynew), abs(ynew)**2, axes=ax)
    ax.set_ylim((-0.5,5))
```



In [29]:
```
Phi.get_parameters()
```

Out[29]:
```
((-2.08166817117e-17+1j), (1-1.17961196366e-16j), 3.29597460436e-17, 0.5, 1.0)
```

We see that the propagation is reversible up to machine precision!