

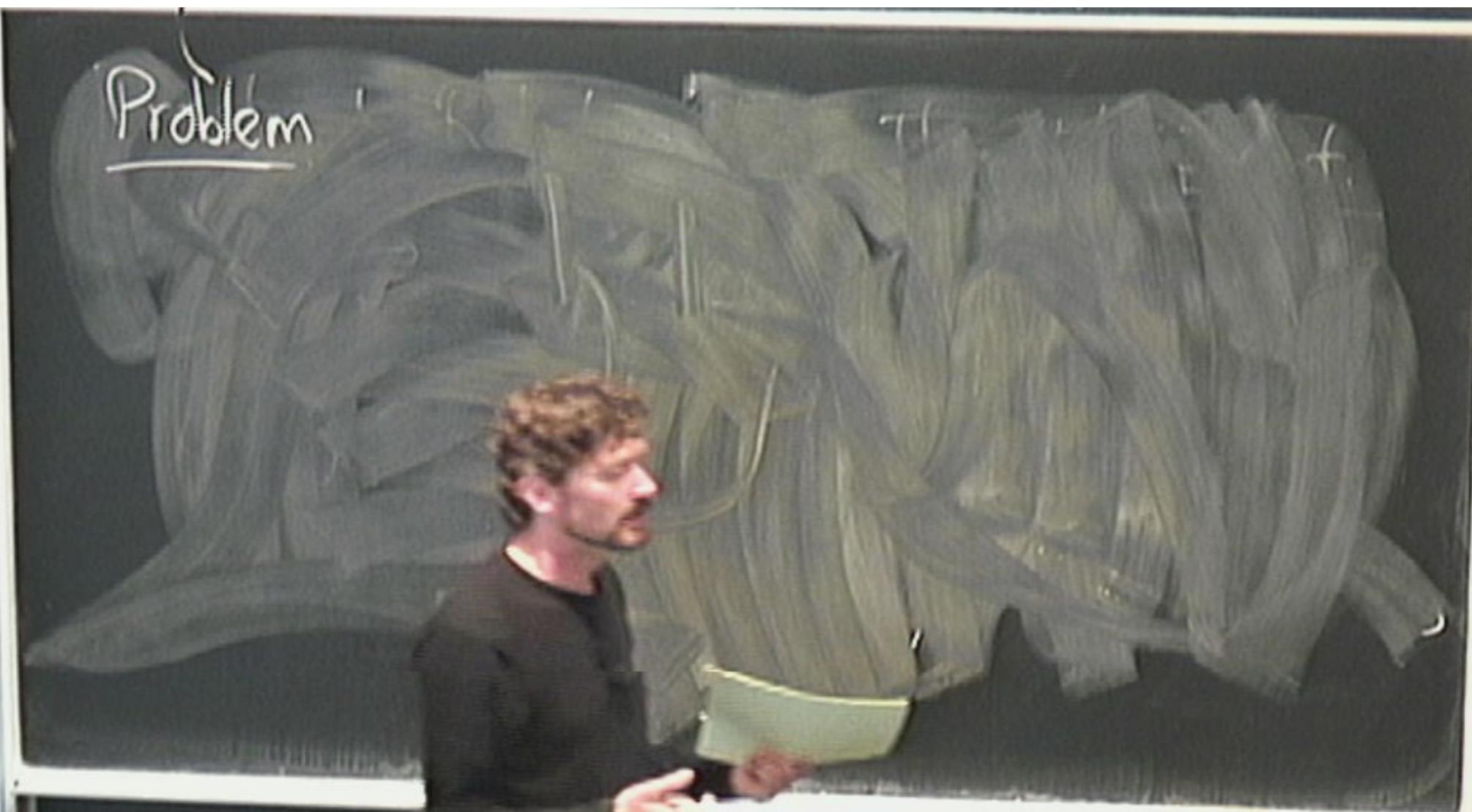
Title: Quantum 4

Date: Jul 27, 2008 10:30 AM

URL: <http://pirsa.org/08070043>

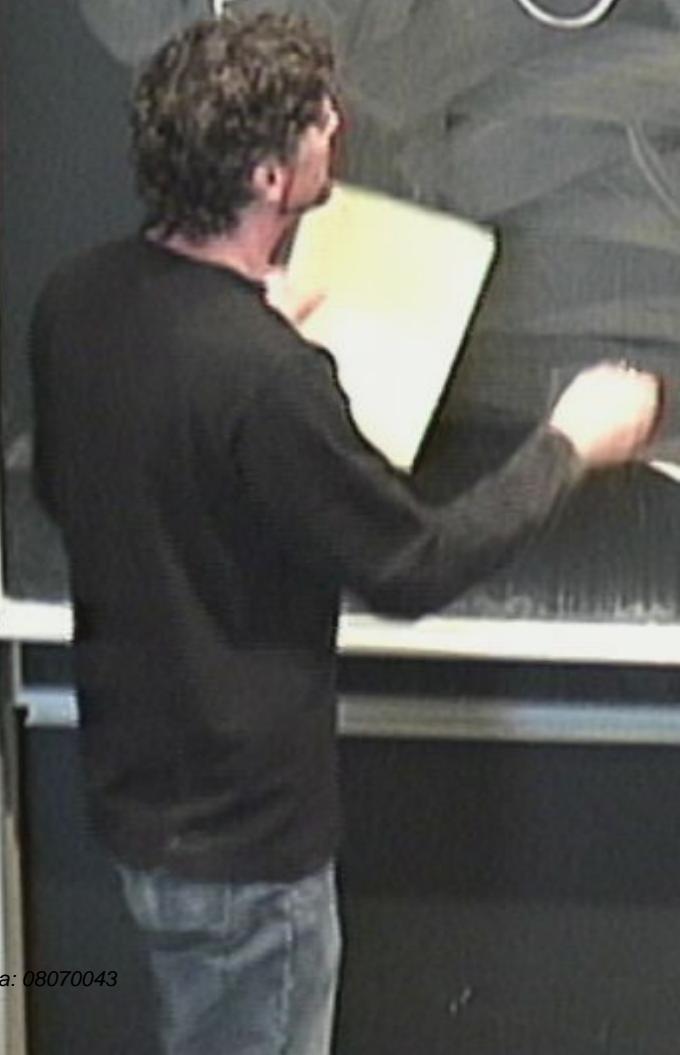
Abstract:

Problem



Problem

$$\psi_p =$$



Problem

$$\psi_R = \text{wavy line} + \phi \rightarrow$$



Problem

$$\psi_R =$$



$$-p$$

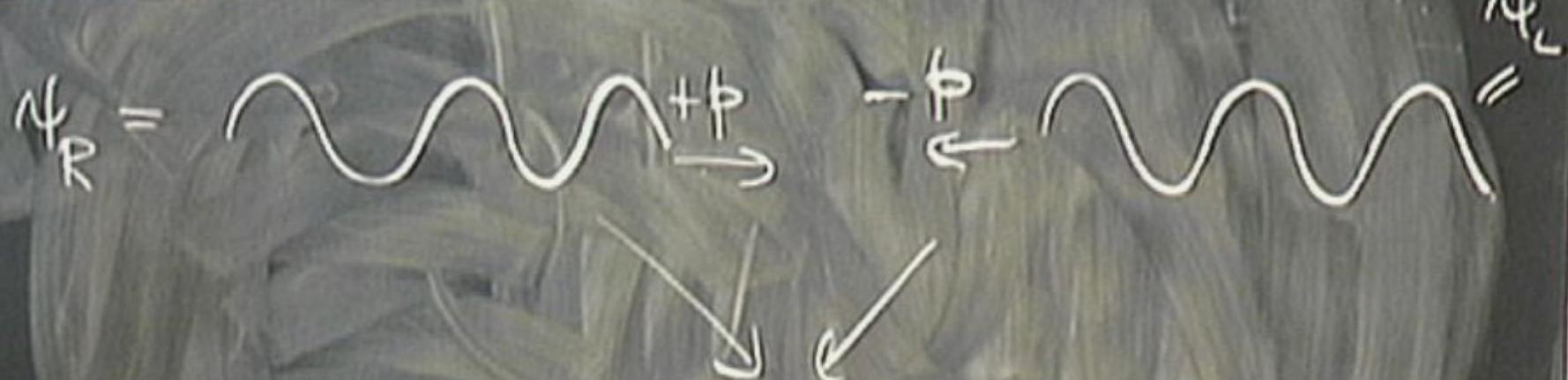


$$\psi_L$$



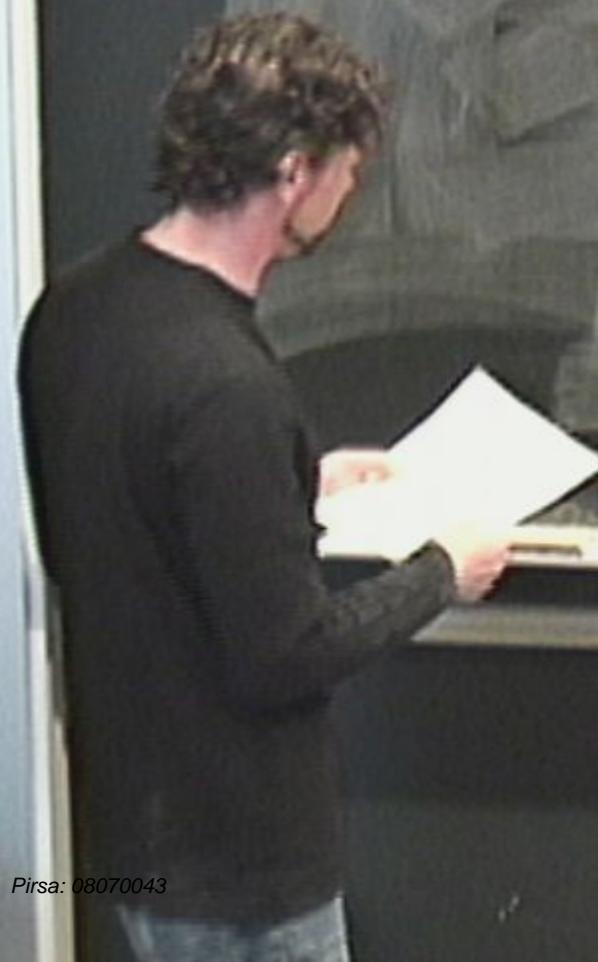
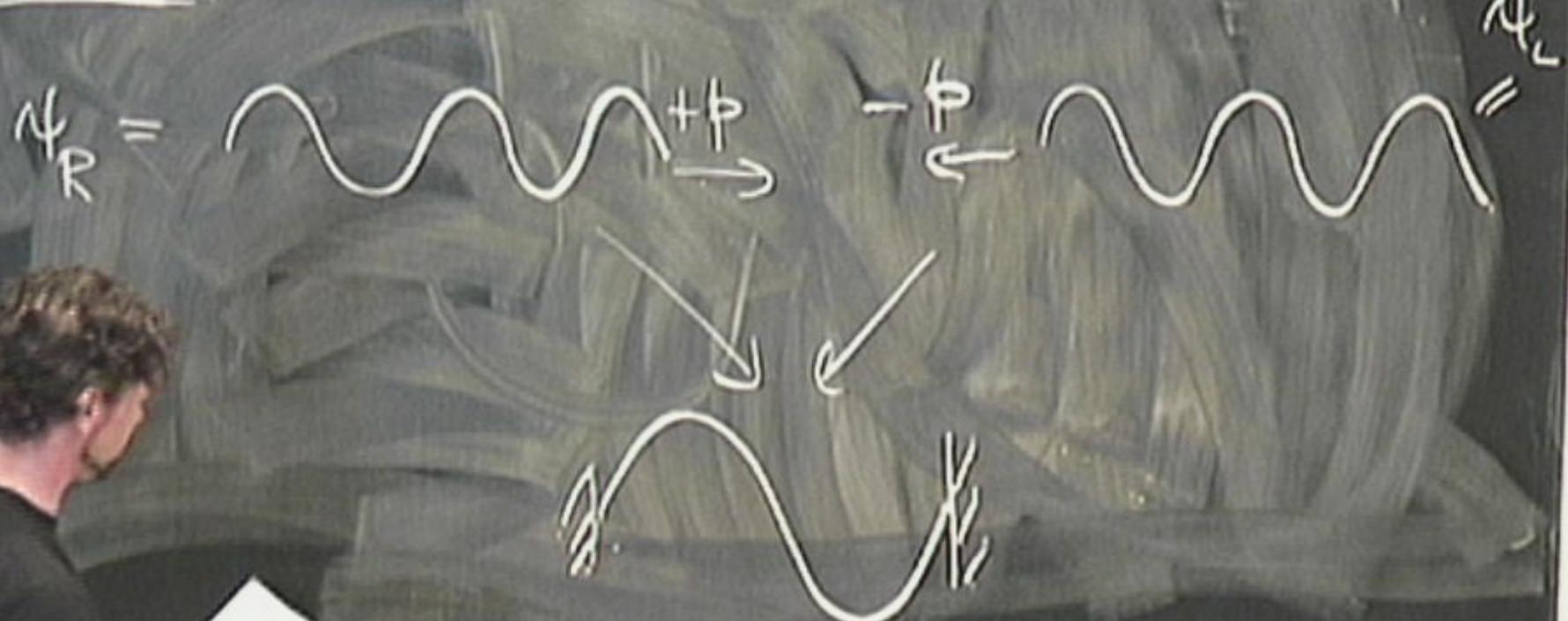
Problem

$$\psi_R = \psi_L + \psi_R'$$



Problem

$$\psi_R =$$



Problem

$$\psi_R =$$



$$-\psi_L$$



Problem

$$\psi_R = \begin{array}{c} \text{wavy line} \\ +\beta \rightarrow -\beta \leftarrow \end{array} = \begin{array}{c} \text{wavy line} \\ \beta \end{array}$$

$\psi_R =$ [wavy line] $+ \beta \rightarrow - \beta \leftarrow$ [wavy line] $=$ [wavy line]

Problem

$$\Psi_R =$$



$$\Psi(x,t) = \Psi_R + \Psi_L$$



Problem

$$\psi_R =$$



$$t=0,$$

$$\psi(x,t) = \psi_R + \psi_L$$



$$\psi_L$$

Problem

$$\Psi_R = \text{wavy line} + \uparrow \rightarrow$$

$$-\downarrow \leftarrow$$

$$t=0, T, 2T, \dots$$

$$t = \frac{T}{2}, \frac{3}{2}T, \dots$$

$$\Psi(x,t) = \Psi_R + \Psi_L$$



interpret: $P(x|A) = \Phi^2(x, t)$

Problem

$$\psi_R =$$



$$-p$$



$$t=0, T, 2T, \dots$$

$$t = \frac{T}{2}, \frac{3}{2}T, \dots$$

$$\psi(x,t) = \psi_R + \psi_L$$



interpret: $P(x,t) = \psi^2(x,t)$

$$\psi^2$$

A hand-drawn diagram on a chalkboard. It consists of a vertical line with a wavy line above it, representing a probability density distribution. The wavy line has several peaks and troughs, indicating the fluctuating nature of the probability density.

interpret: $P(x,t) = \psi^2(x,t)$



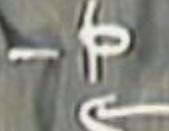
$$\psi^2 = P$$

Problem

$$\Psi_R =$$



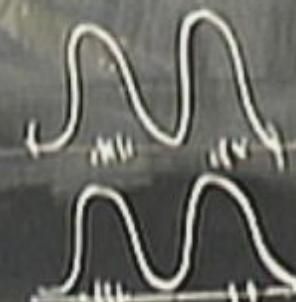
$$-\hat{p}$$



$$t=0, T, 2T, \dots$$

$$t = \frac{T}{2}, \frac{3}{2}T, \dots$$

$$\Psi(x,t) = \Psi_R + \Psi_L$$



interpret: $P(x,t) = \psi^2(x,t)$

$$t = \frac{T}{4} \quad \psi = +$$



$$\psi^2 = P$$

Problem

$$\Psi_R =$$



$$-\frac{P}{2}$$

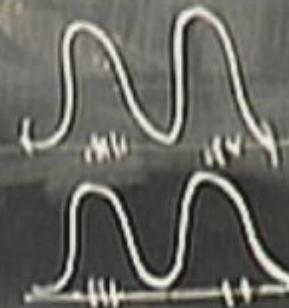


$$t = 0, T, 2T, \dots$$

$$\Psi(x,t) = \Psi_R + \Psi_L$$



$$t = \frac{T}{2}, \frac{3}{2}T, \dots$$



interpret: $P(x,t) = |\psi(x,t)|^2$

$$t = \frac{1}{4} \quad \psi = +$$

$$P = - \xrightarrow{\text{zero}}$$



Problem

$$\psi_R =$$



$$-\dot{P}$$

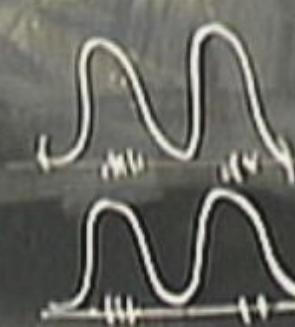


$$t=0, T, 2T, \dots$$

$$\psi(x,t) = \psi_R + \psi_L$$



$$t = \frac{T}{2}, \frac{3}{2}T, \dots$$



Problem

$$\psi_R = \text{wavy line} + p$$

$$t=0, T, 2T, \dots$$

$$\psi_L = \text{wavy line} - p$$

$$t = \frac{T}{2}, \frac{3}{2}T, \dots$$

$$\psi(x,t) = \psi_R + \psi_L$$



interpret: $P(x,t) = \Psi^2(x,t)$

$$t = \frac{T}{4} \quad \Psi = +$$

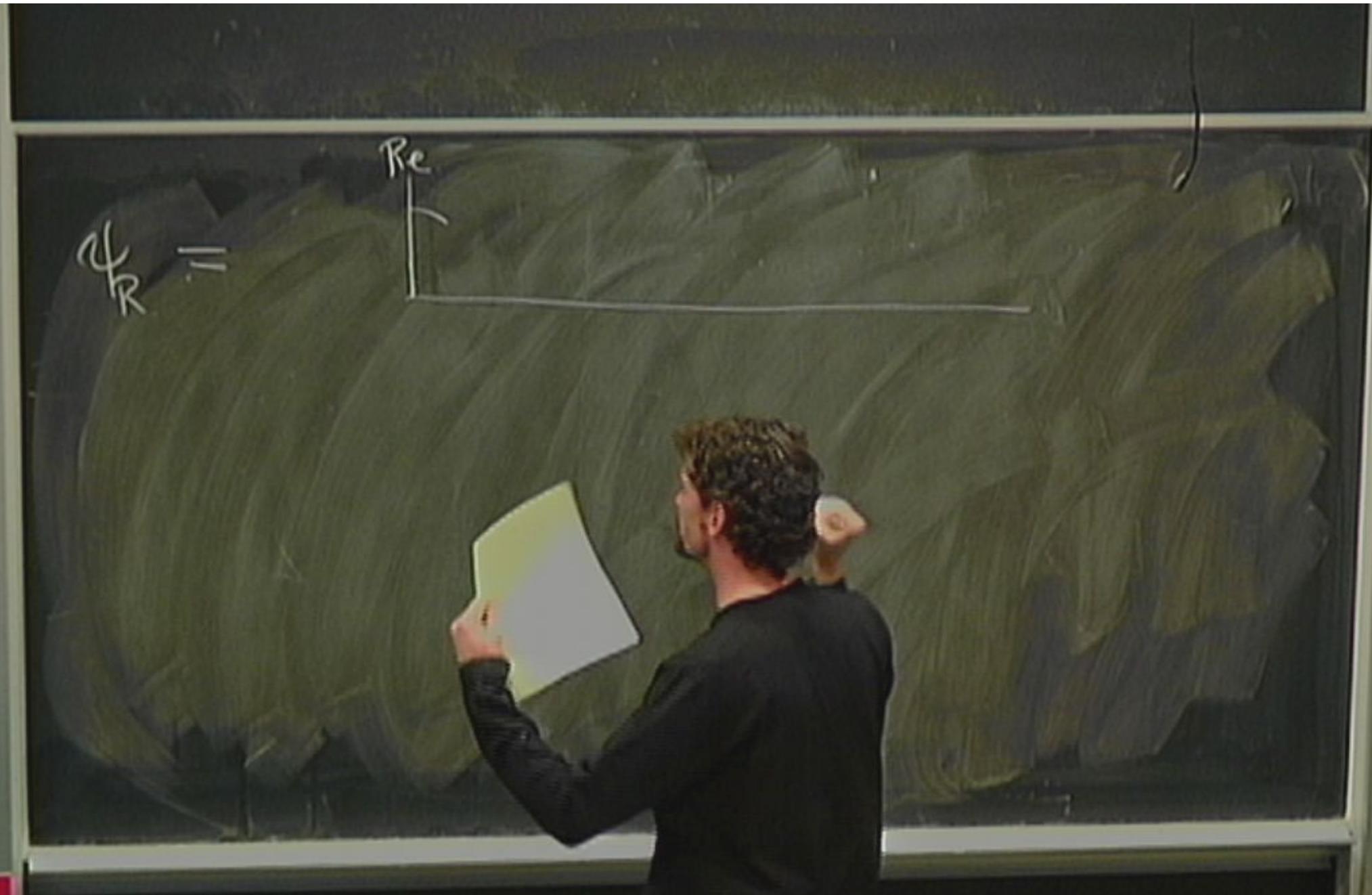
$$P = + \rightarrow \underline{\underline{200}}$$

Ψ_R, Ψ_U ... are complex travelling waves.



$$\Psi^2 = P$$

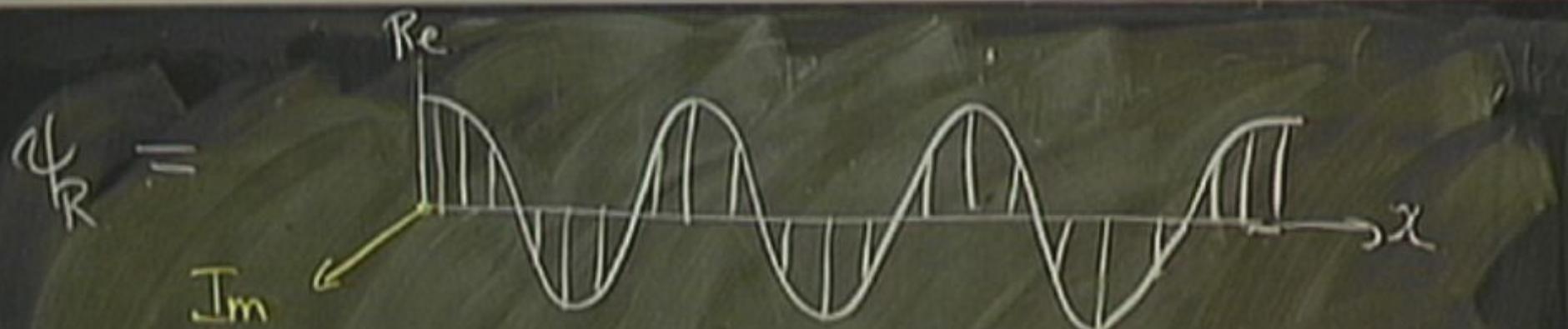
$$\psi_R =$$

$$Re$$


$$\psi_R = \Re h$$

A chalkboard with a hand-drawn diagram of a wave function. The diagram shows a periodic wave oscillating along a horizontal axis labeled x . The wave has several full cycles. Above the wave, the label \Re is written above the letter h . To the left of the wave, there is a partial derivative symbol (d/dx) followed by an equals sign, indicating the real part of the wave function.



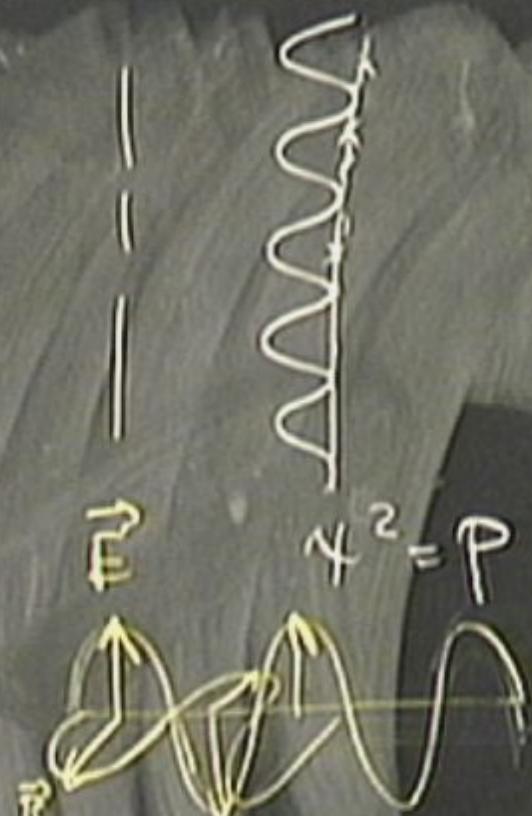


interpret: $P(x,t) = \psi^2(x,t)$

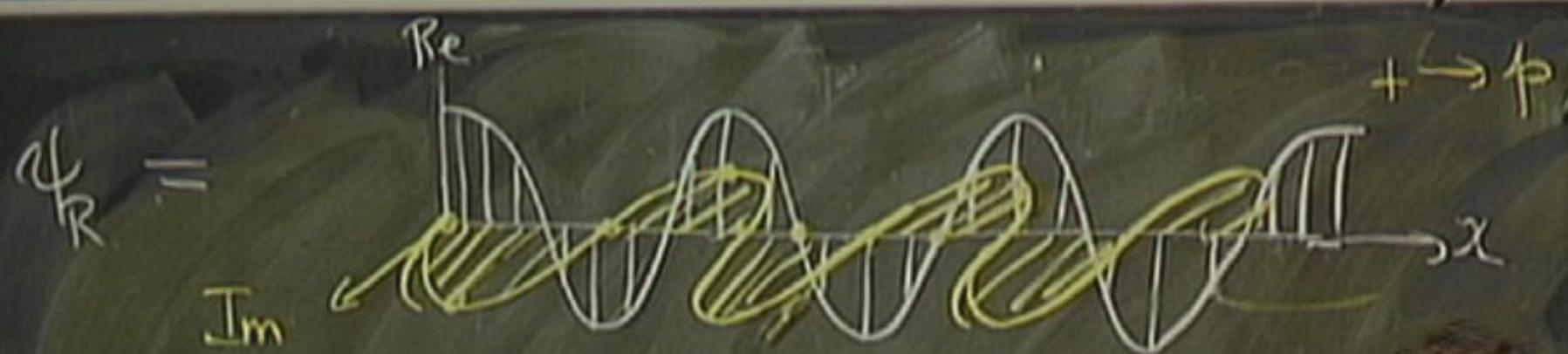
$$t = \frac{T}{4} \quad \psi = + \rightarrow$$

$$P = + \rightarrow \underset{\approx}{\text{zero}}$$

ψ_R, ψ_L ... are complex travelling waves.



$\psi_R =$ 



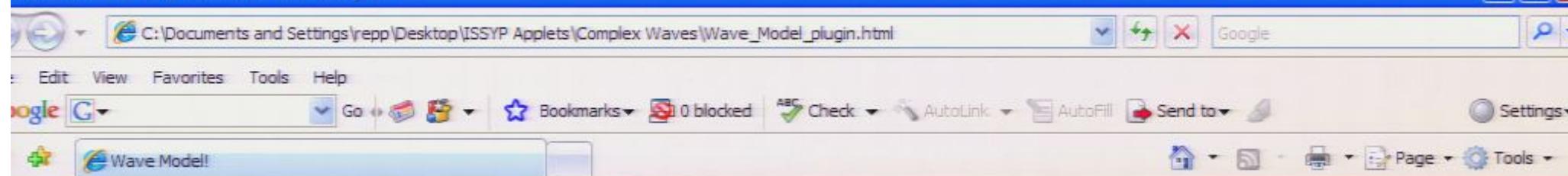
$$\psi_R = \begin{aligned} & \text{Re} \\ & \text{Im} \end{aligned}$$

$$= \cos \left[\frac{i}{\hbar} (p_x - Et) \right]$$

$$\psi_R = e^{i \frac{p}{\hbar} x - i \frac{E}{\hbar} t}$$
$$= \cos\left[\frac{i}{\hbar}(px - Et)\right] + i \sin\left[\frac{i}{\hbar}(px - Et)\right]$$

$$\psi_R = \frac{b}{\sqrt{\pi}} e^{i \frac{p}{\hbar} x - i \frac{E}{\hbar} t}$$
$$= \cos\left[\frac{i}{\hbar}(px - Et)\right] + i \sin\left[\frac{i}{\hbar}(px - Et)\right]$$
$$= e^{i \frac{p}{\hbar} x - i \frac{E}{\hbar} t} = \text{complex travelling wave.}$$

Wave Model! - Windows Internet Explorer



Animation:

Play

Stop

Animation Speed (ms):

500 20000

Reset

Click on 'Next' to proceed to the two-wave interference model.

< Previous

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Wave Model! - Windows Internet Explorer



Animation:

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Stop

Animation Speed (ms):

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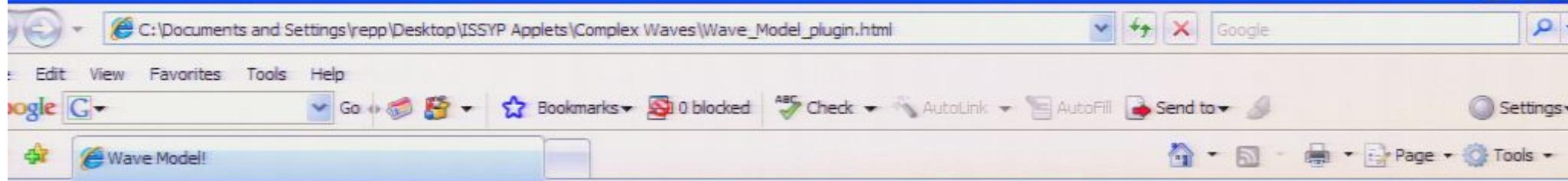
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Animation:

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Stop

Animation Speed (ms):

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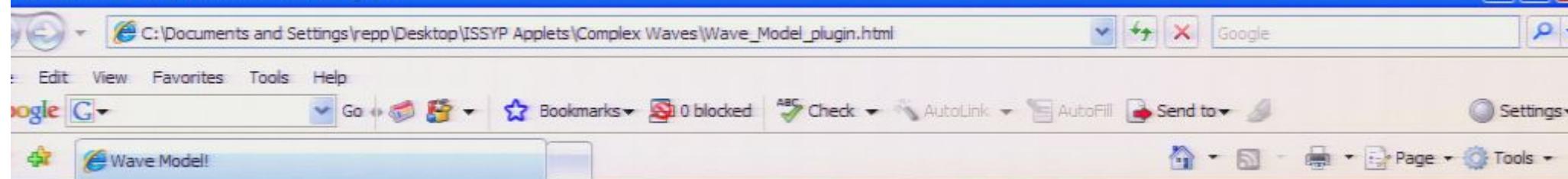
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Wave Model! - Windows Internet Explorer



Animation:

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Stop

Animation Speed (ms):

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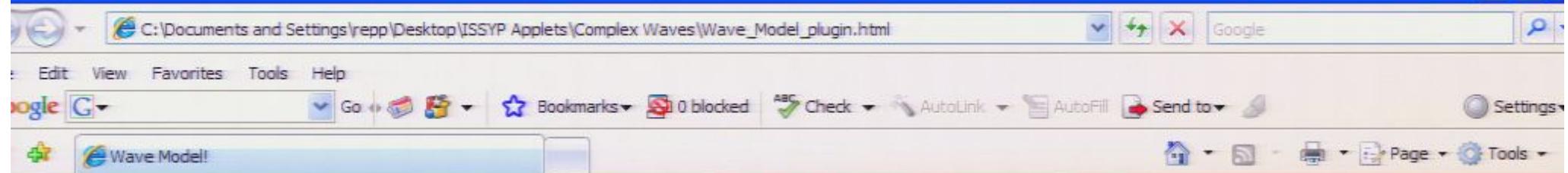
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Click on 'Next' to proceed to the two-wave interference model.

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Animation:

Play

Stop

Animation Speed (ms):

500 20000

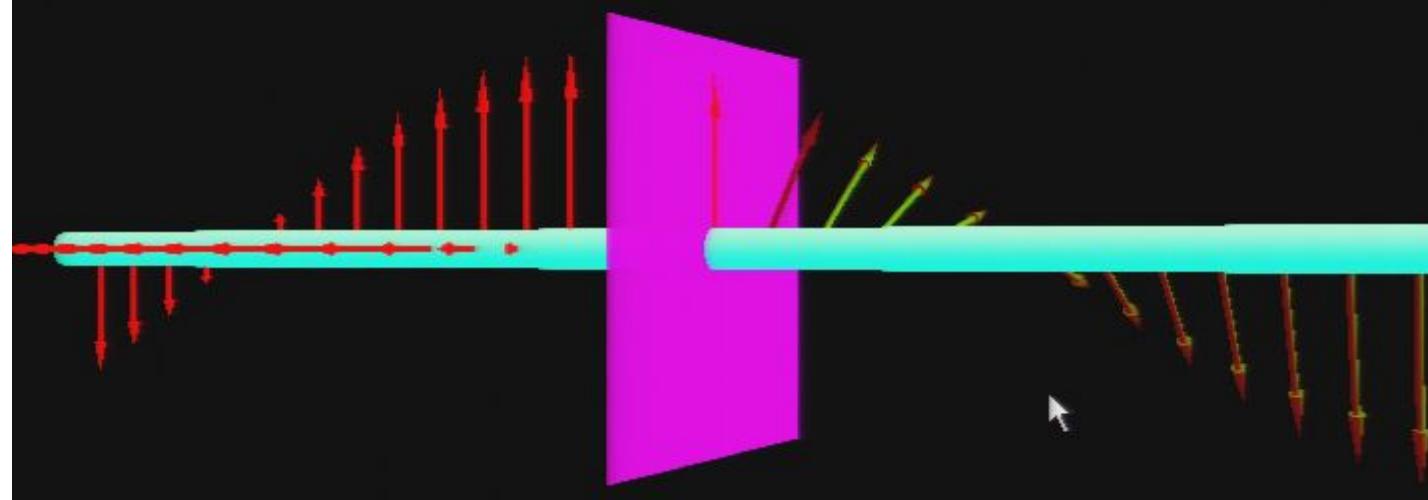
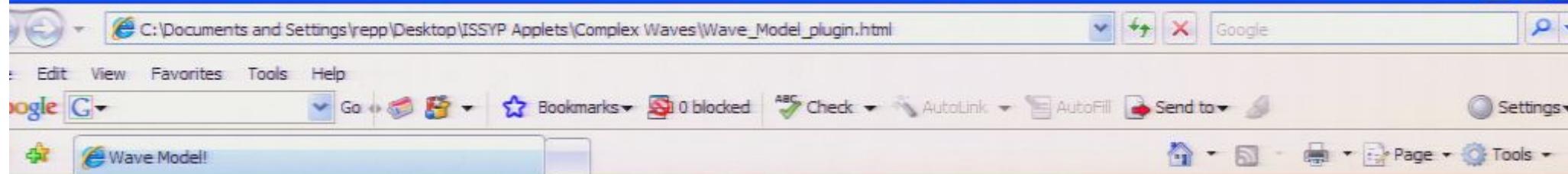
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Animation:

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Stop

Animation Speed (ms):

500 20000

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Animation:

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Animation Speed (ms):

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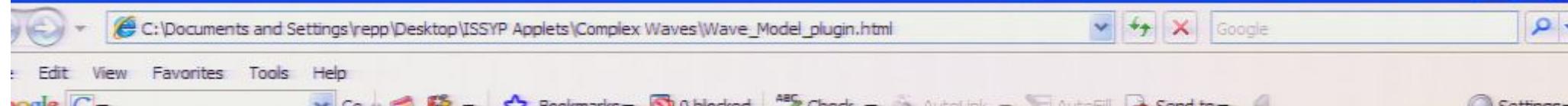
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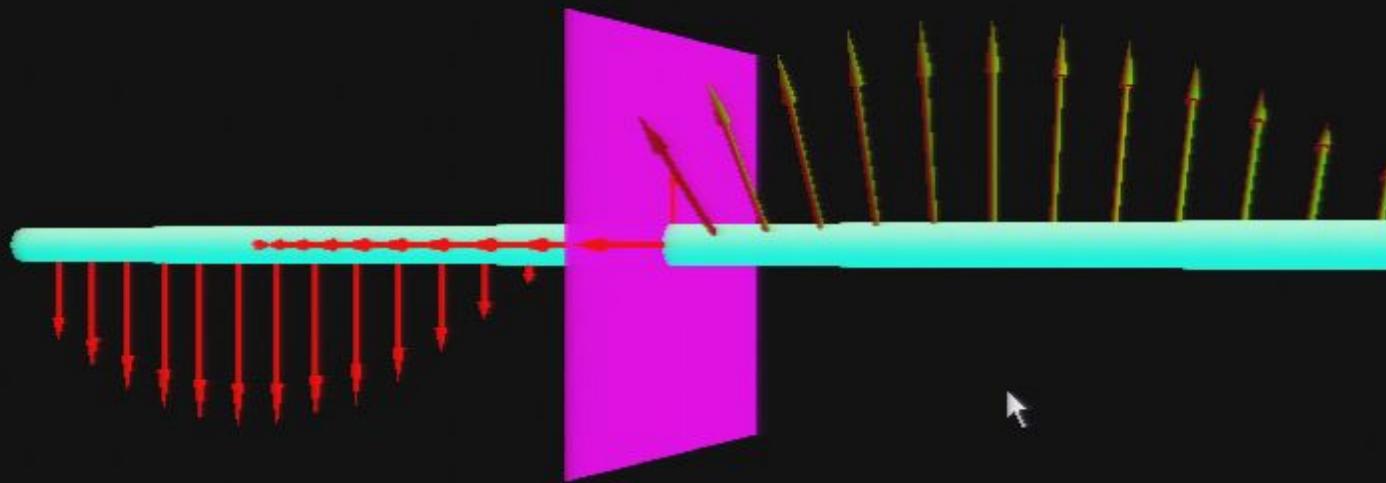
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Wave Model!



Animation:

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Stop

Animation Speed (ms):

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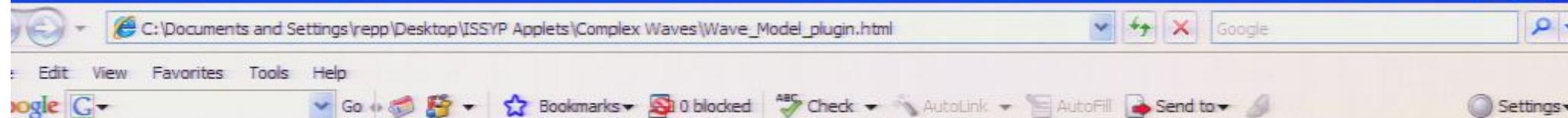
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Animation:

Play

Stop

Animation Speed (ms):

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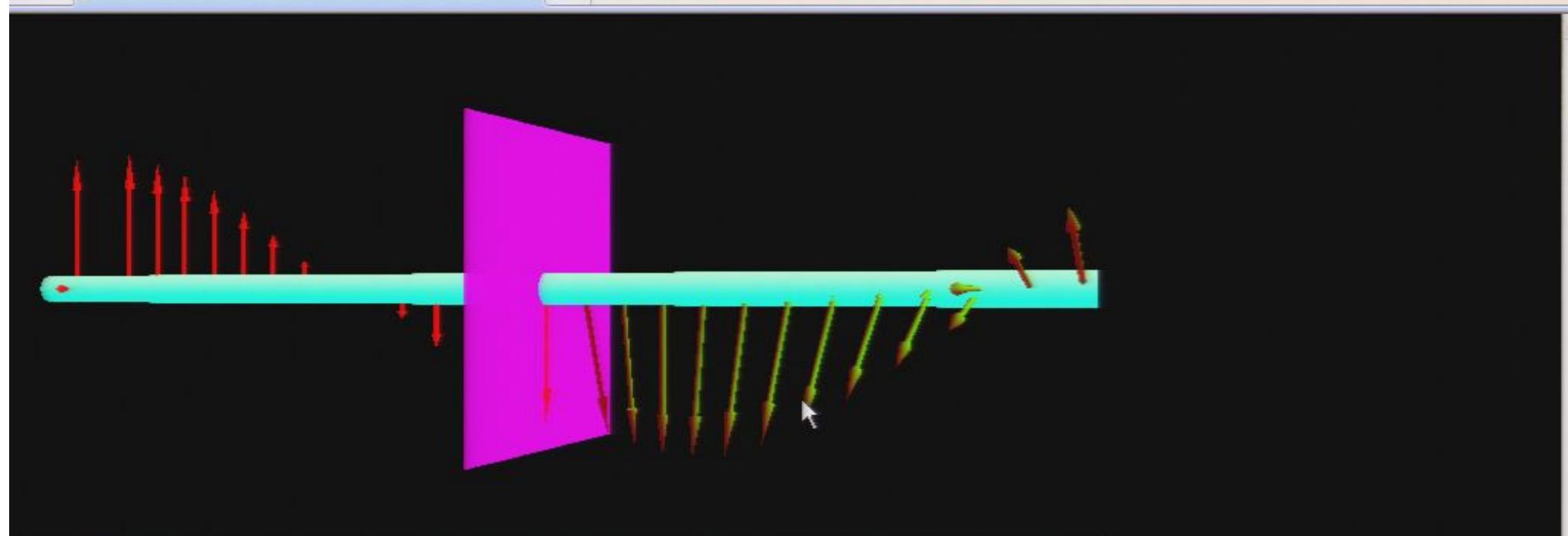
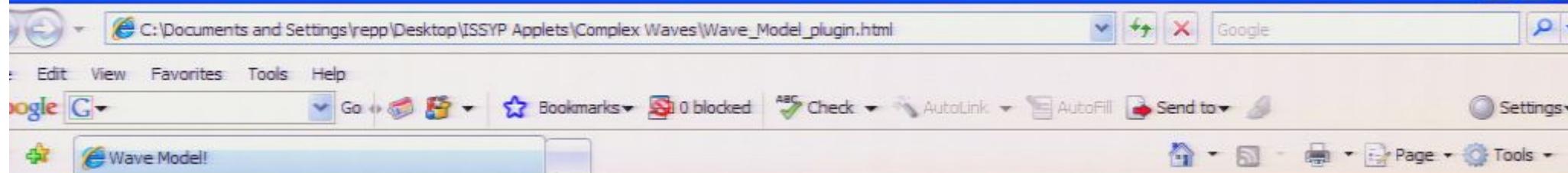
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Animation:

Play

Stop

Animation Speed (ms):

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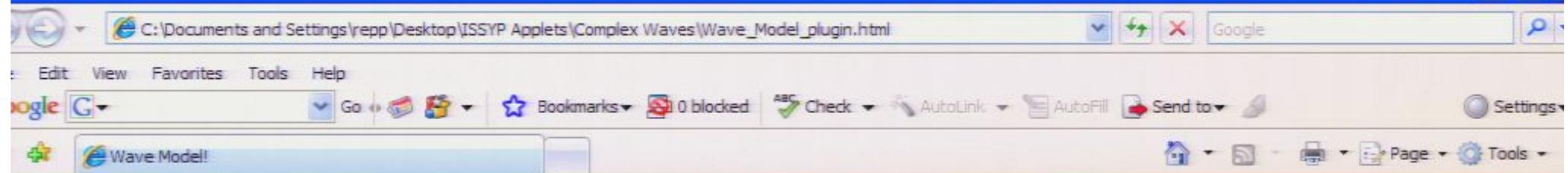
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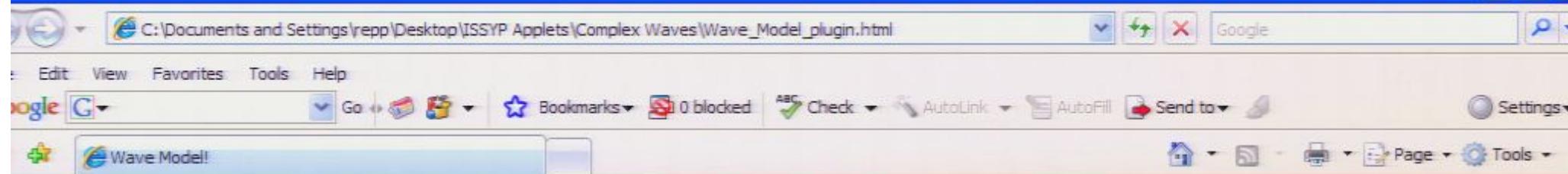
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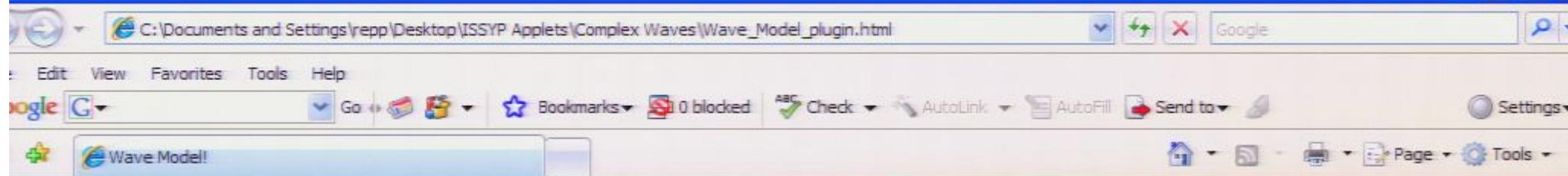
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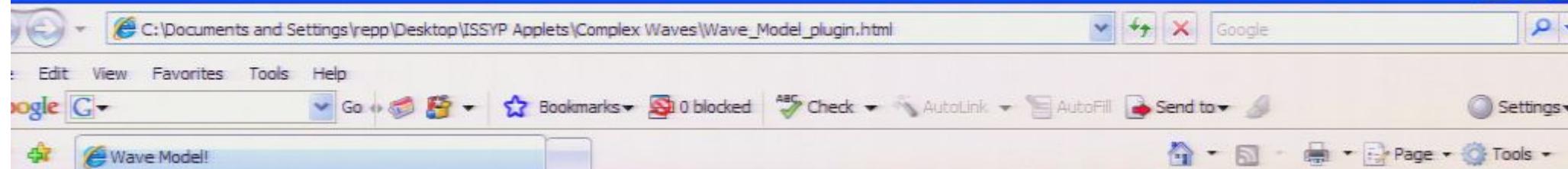
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Animation:

Play

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Animation Speed (ms):

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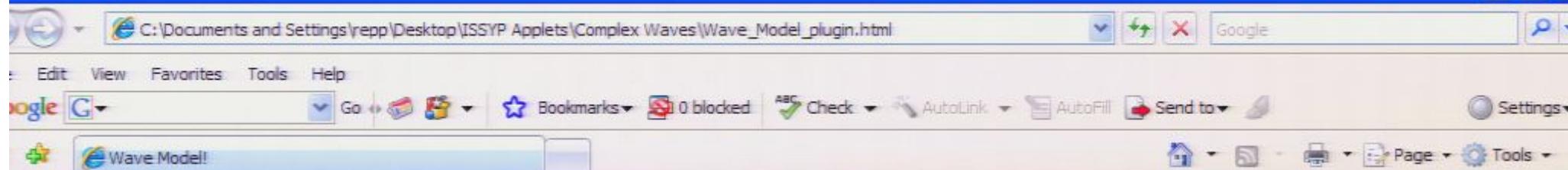
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Play Stop

Animation Speed (ms): 500 20000

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Wave Model! - Windows Internet Explorer



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Animation Speed (ms):

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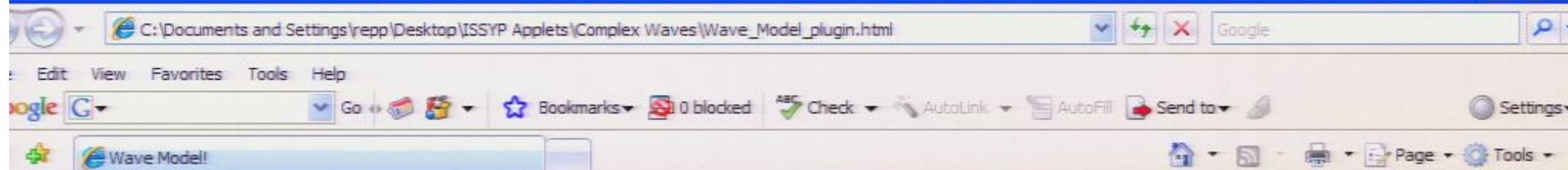
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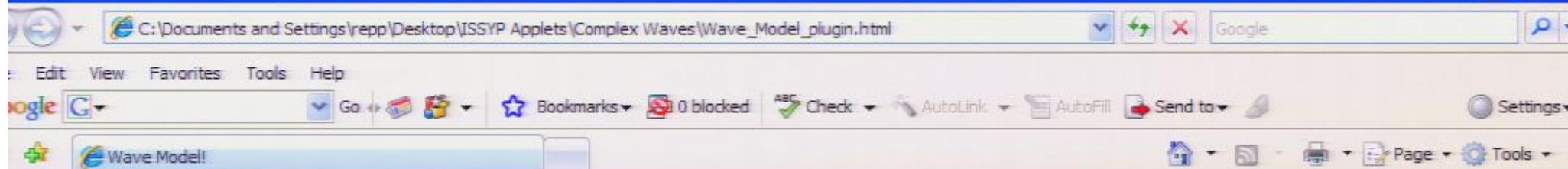
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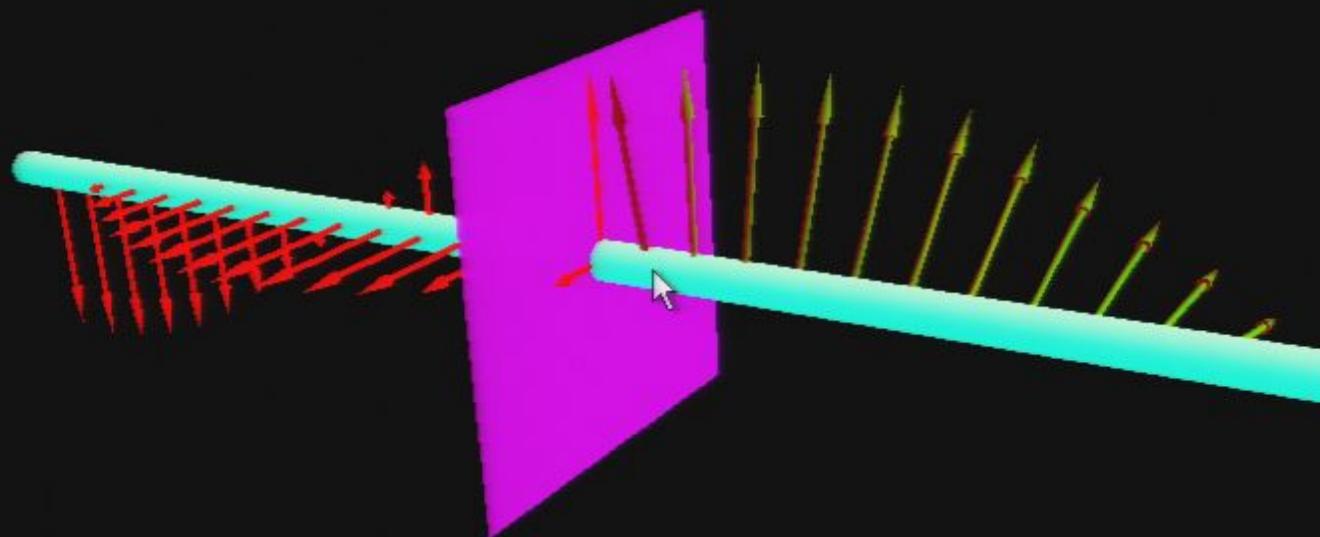
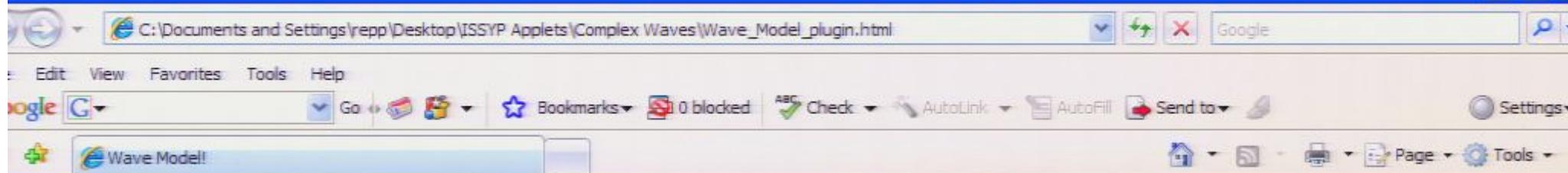
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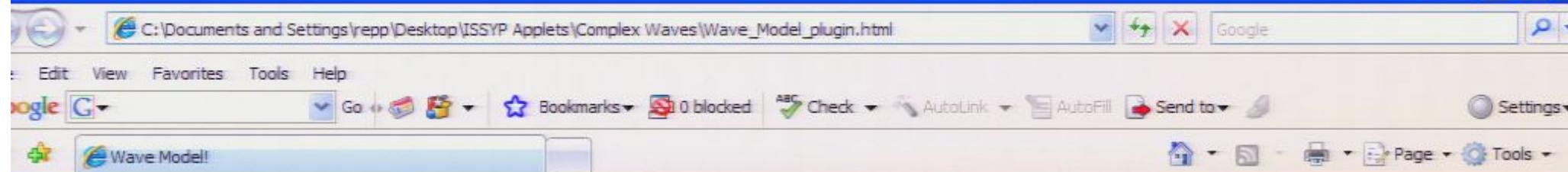
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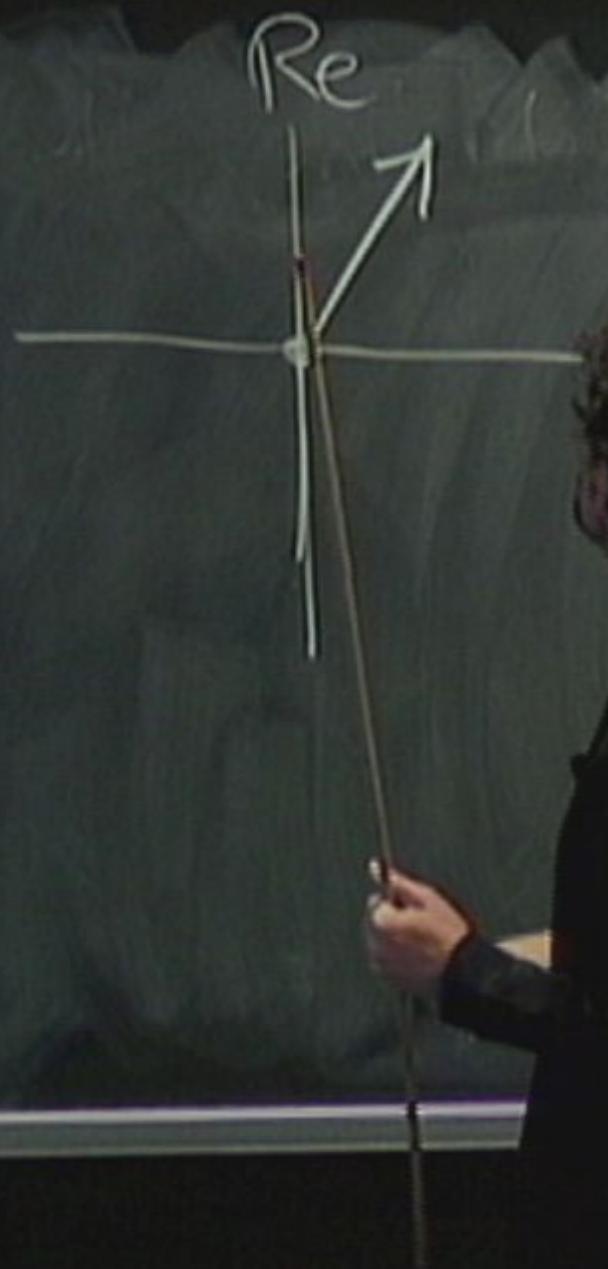
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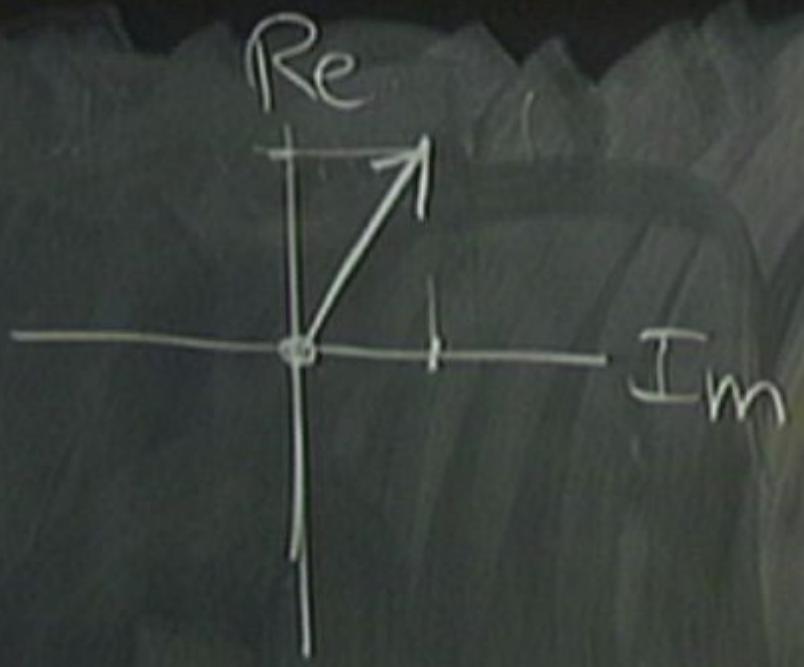
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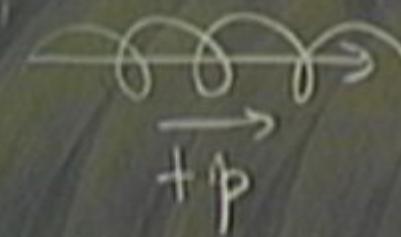
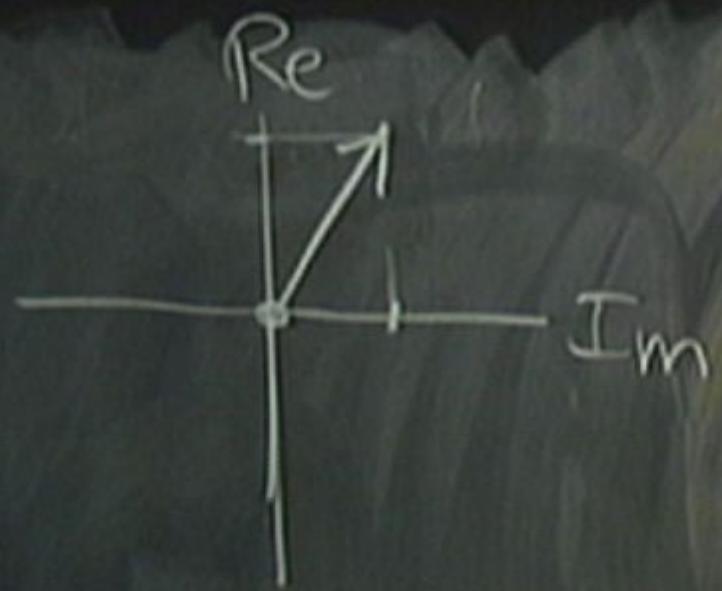
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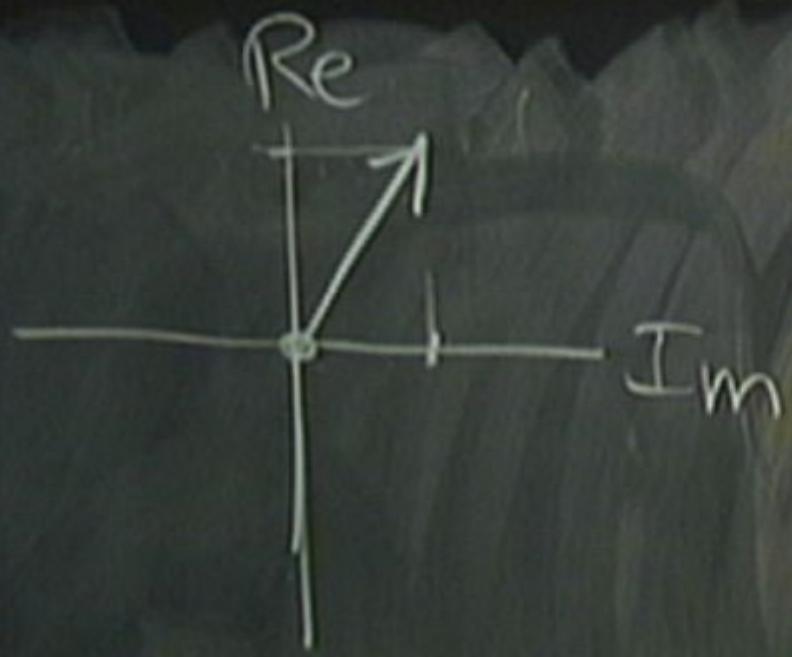
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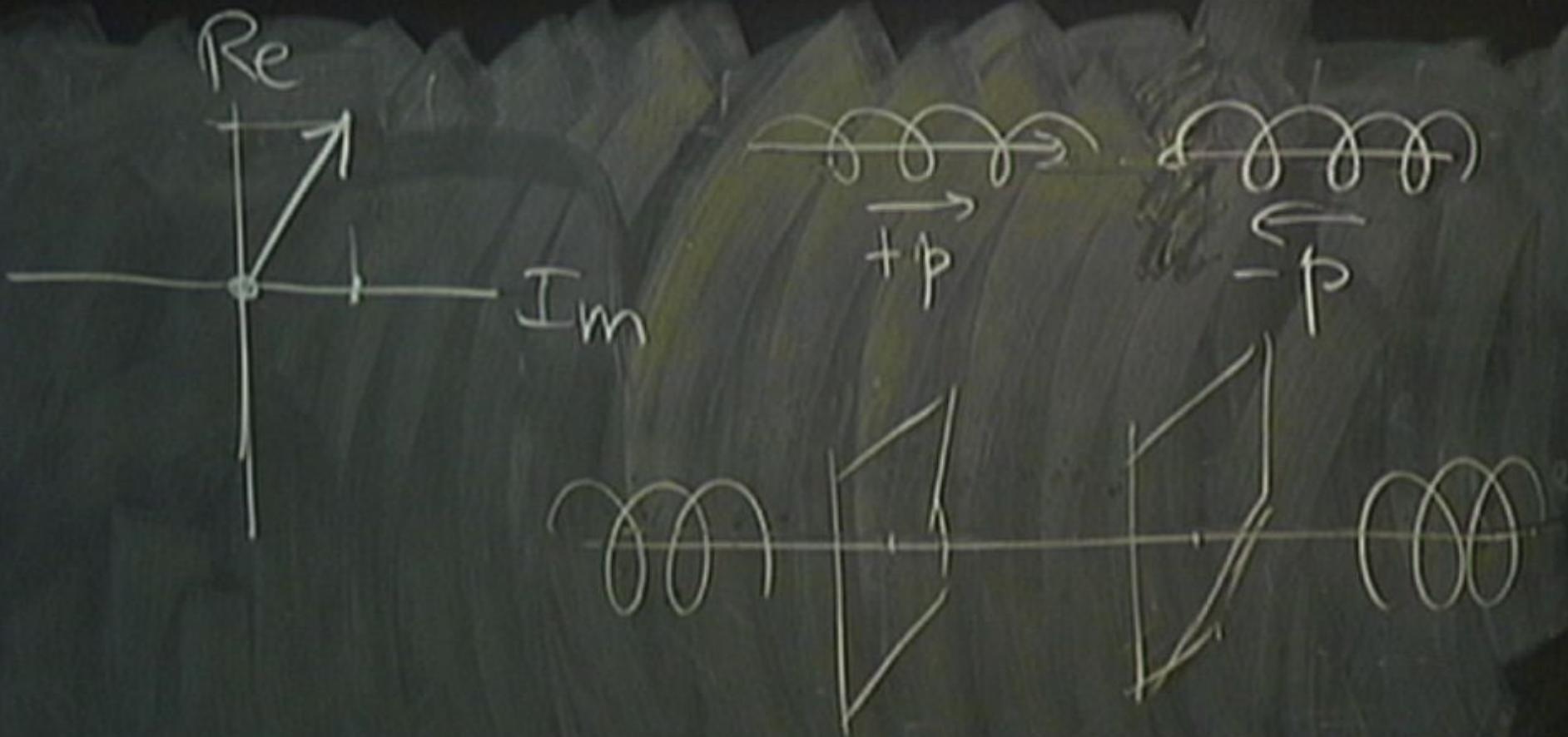
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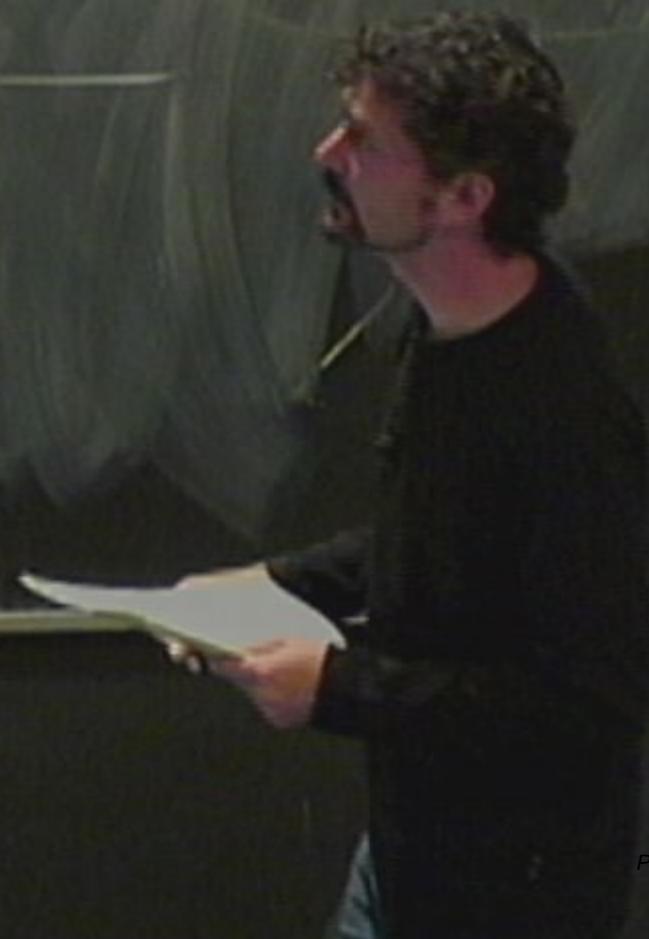
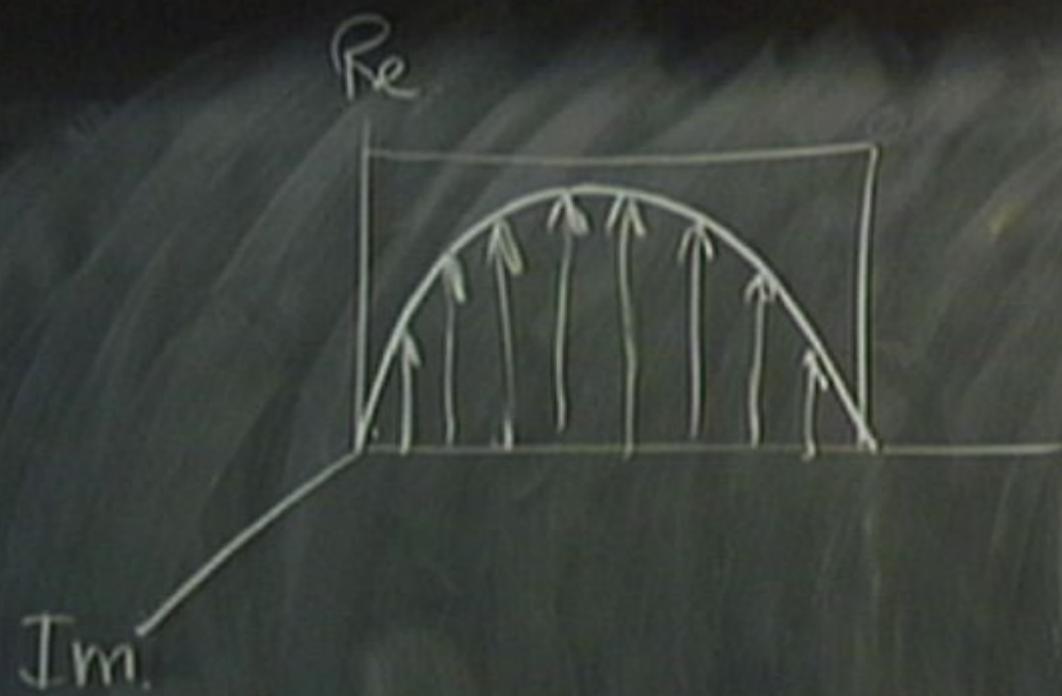


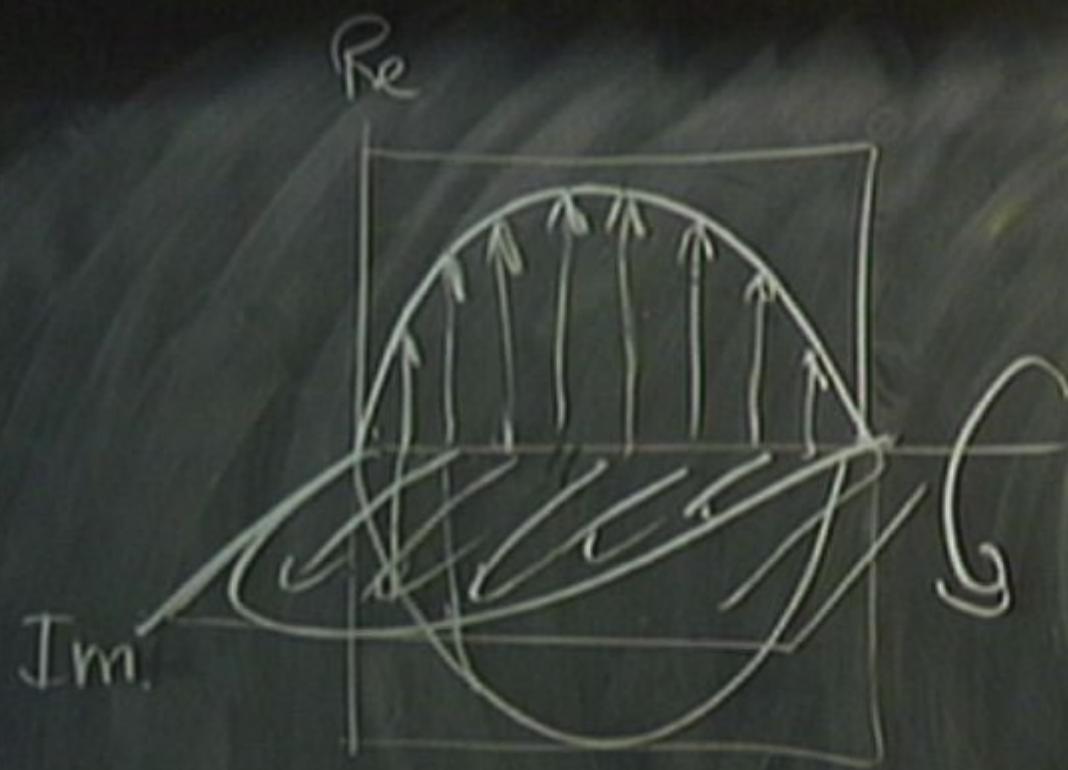


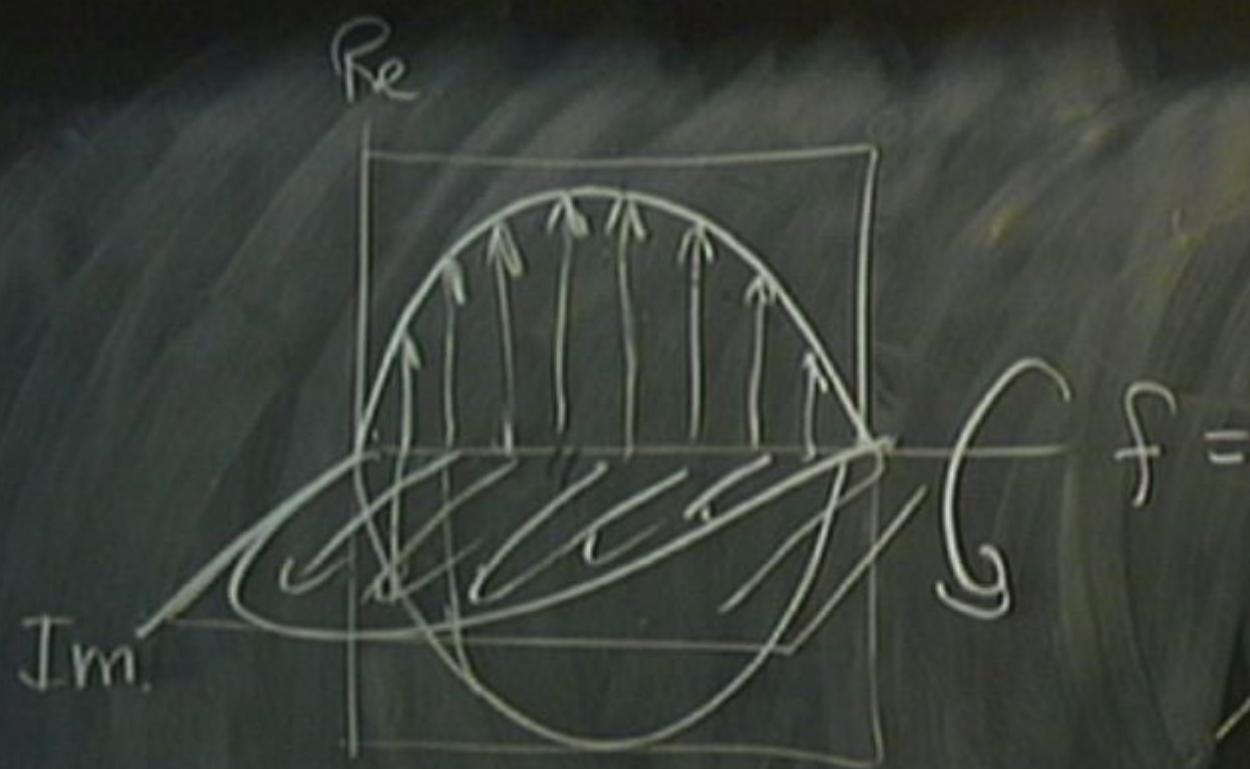


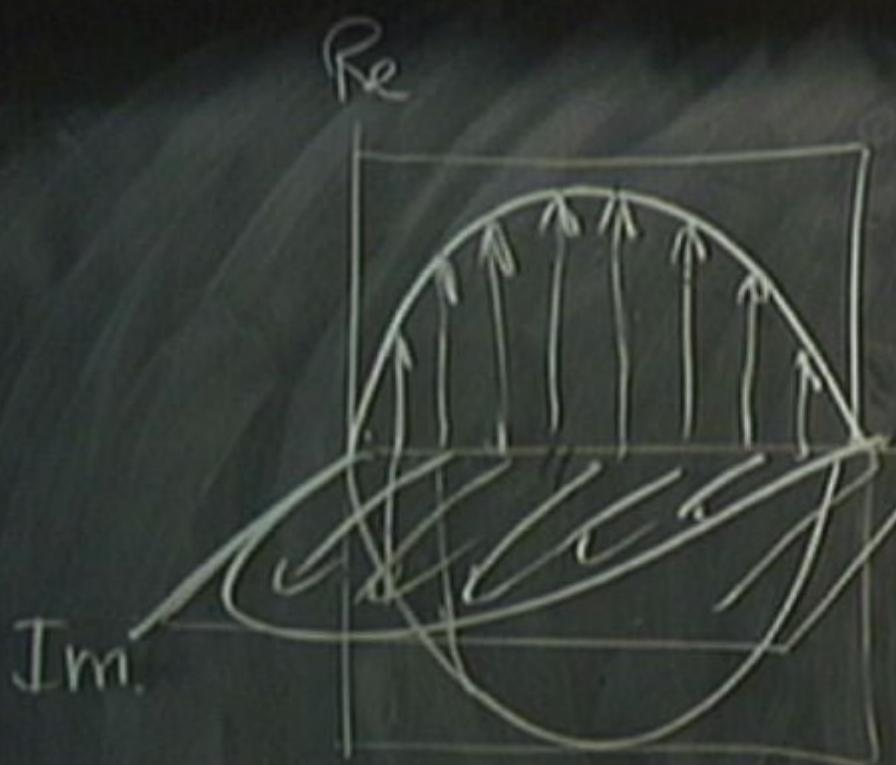






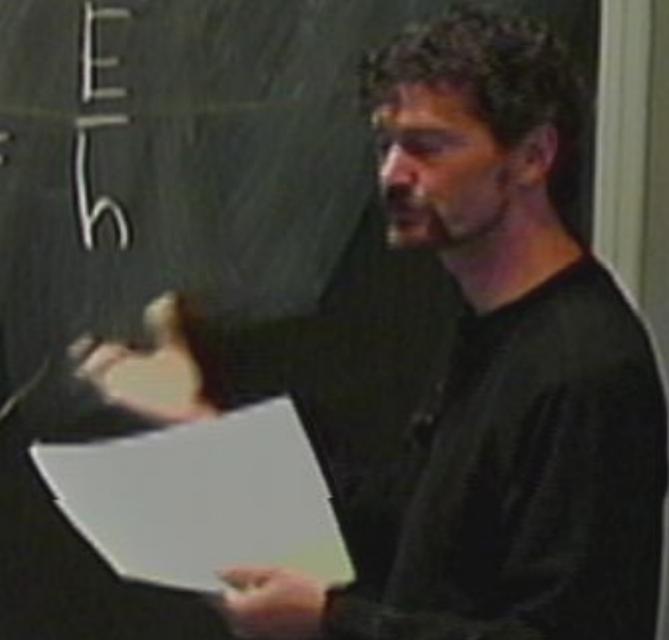




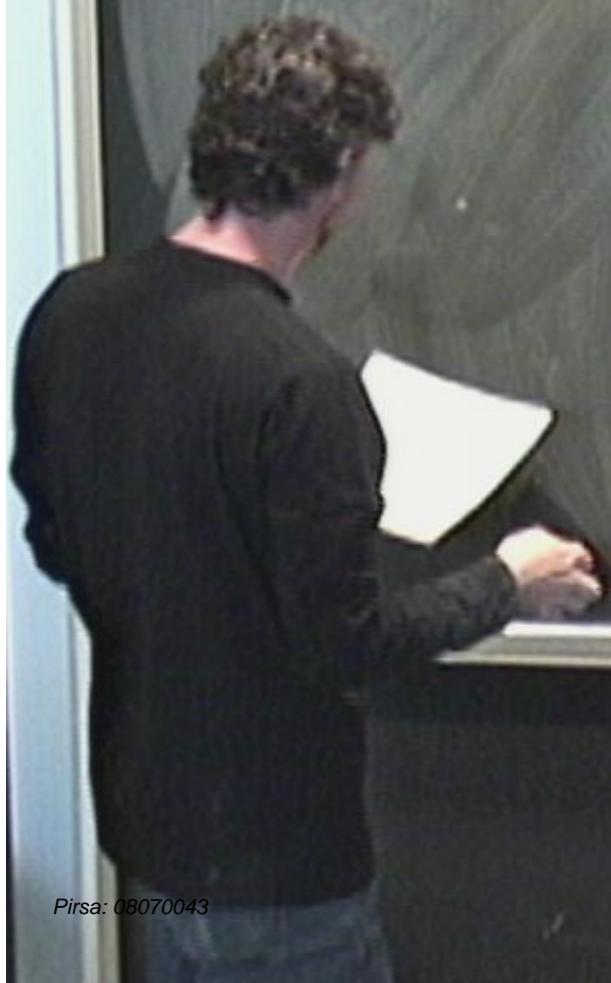


$$E = hf$$

$$C f = \frac{E}{\hbar}$$



So What?



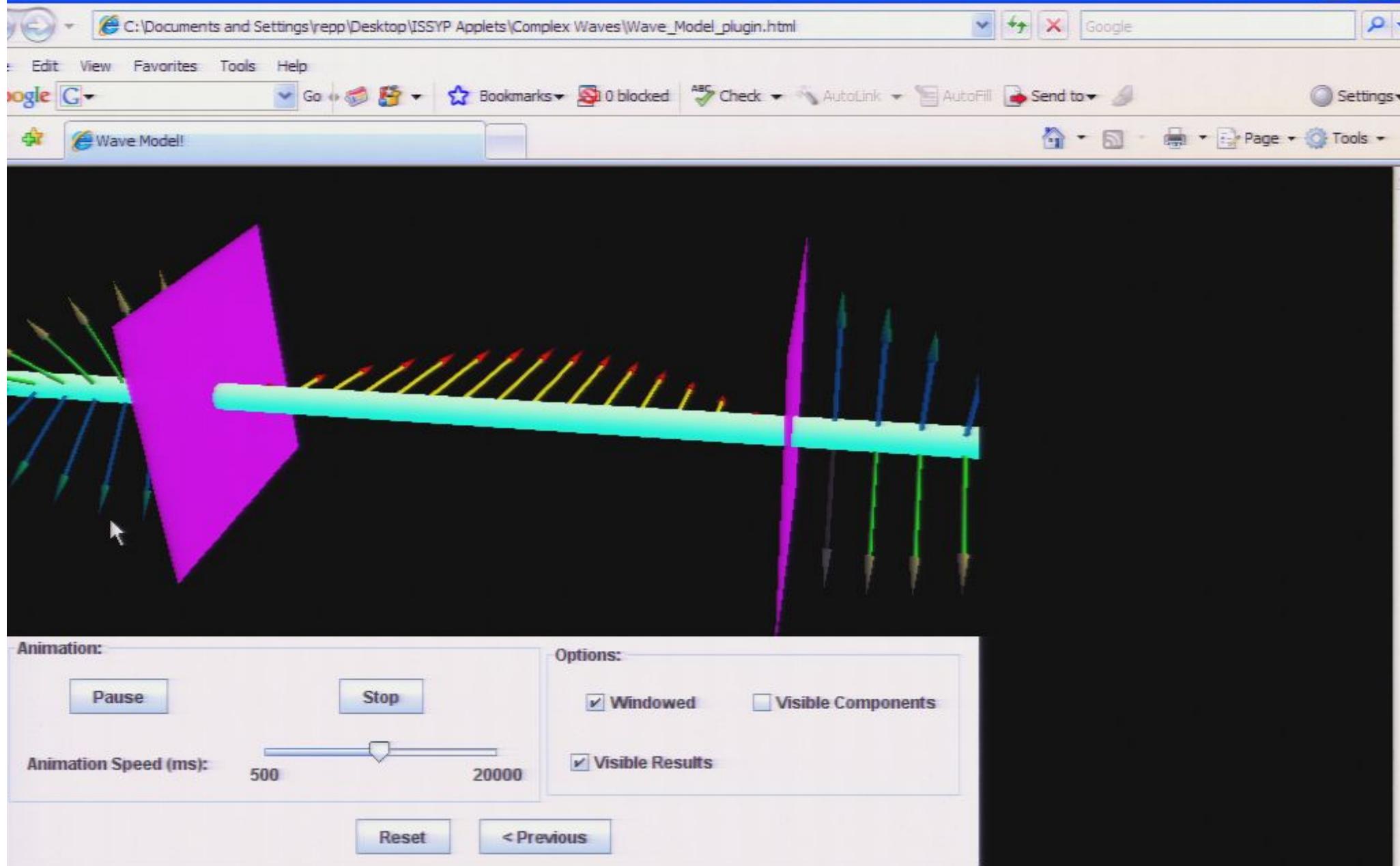
So What?

$$P = \pi r^2$$

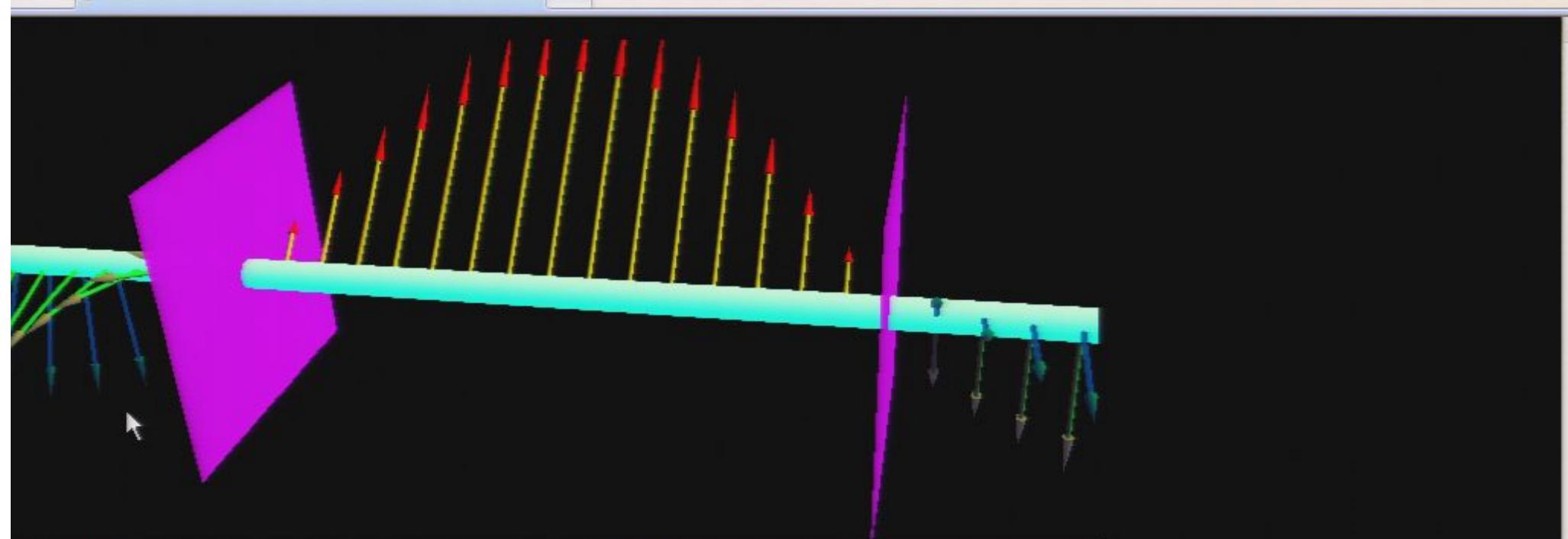
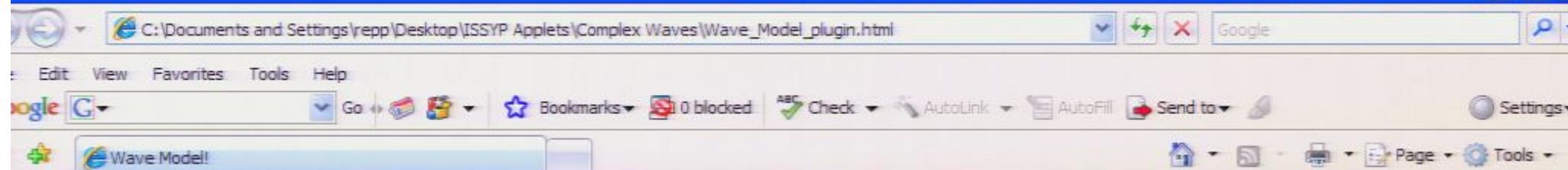
So What?

$$P = \psi^2 \rightarrow P = |\psi|^2$$

Wave Model! - Windows Internet Explorer



Wave Model! - Windows Internet Explorer



Animation:

Animation Speed (ms):

500 20000

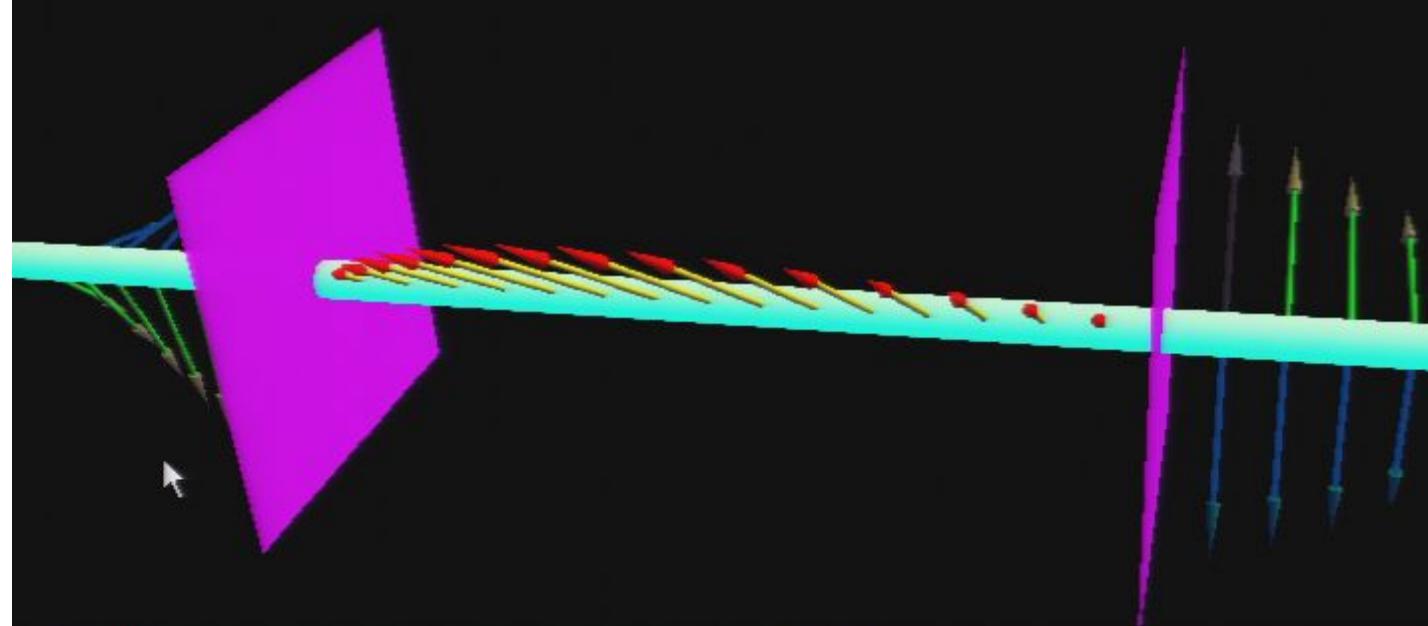
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Windowed

Visible Components

Visible Results

Wave Model! - Windows Internet Explorer



Animation:

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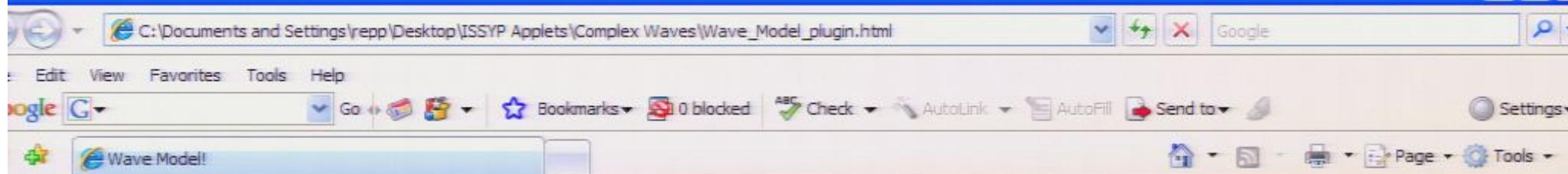
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Visible Results

Wave Model! - Windows Internet Explorer



Animation:

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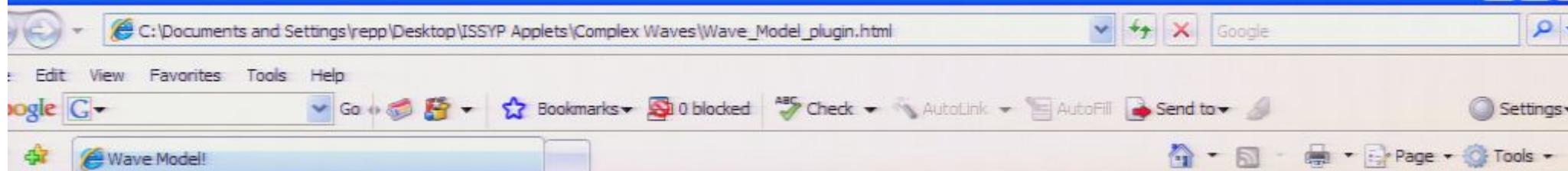
Options:

Windowed

Visible Components

Visible Results

Wave Model! - Windows Internet Explorer



Animation:

Animation Speed (ms):

500 20000

Options:

Windowed

Visible Components

Visible Results

So What?

$$P = |\psi|^2 \rightarrow P = |\psi|^2 = \int |A|^2$$

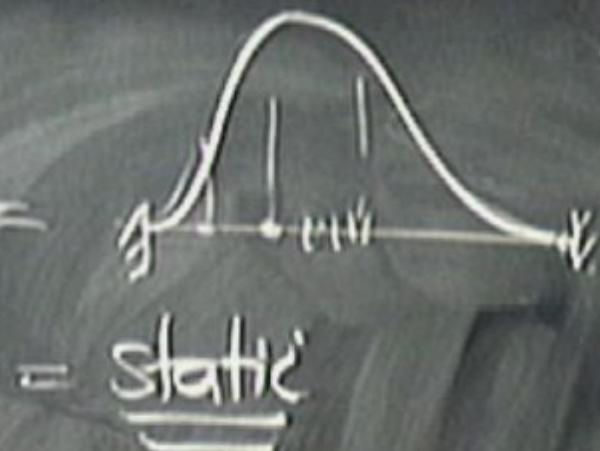
So What?

$$P = N^2 \rightarrow P = |\psi|^2 =$$


= static

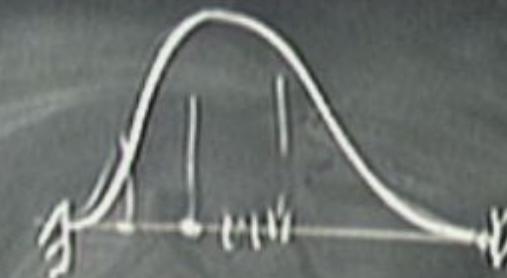
So What?

$$P = N^2 \rightarrow P = |\psi|^2$$



→ stationary state

So What?

$$P = \psi^2 \rightarrow P = |\psi|^2 =$$


= static

→ stationary state

1-d Quantum Transitions Applet v1.5

View

Setup: Infinite Well

Clear

Rescale Graphs

Stop Radiation

Reverse Phase

Stopped

Simulation Speed

Radiation Intensity

Radiation Frequency

Resolution

Electric Field: Current:



1-d Quantum Transitions Applet v1.5

View

Setup: Infinite Well

Clear

Rescale Graphs

Stop Radiation

Reverse Phase

Stopped

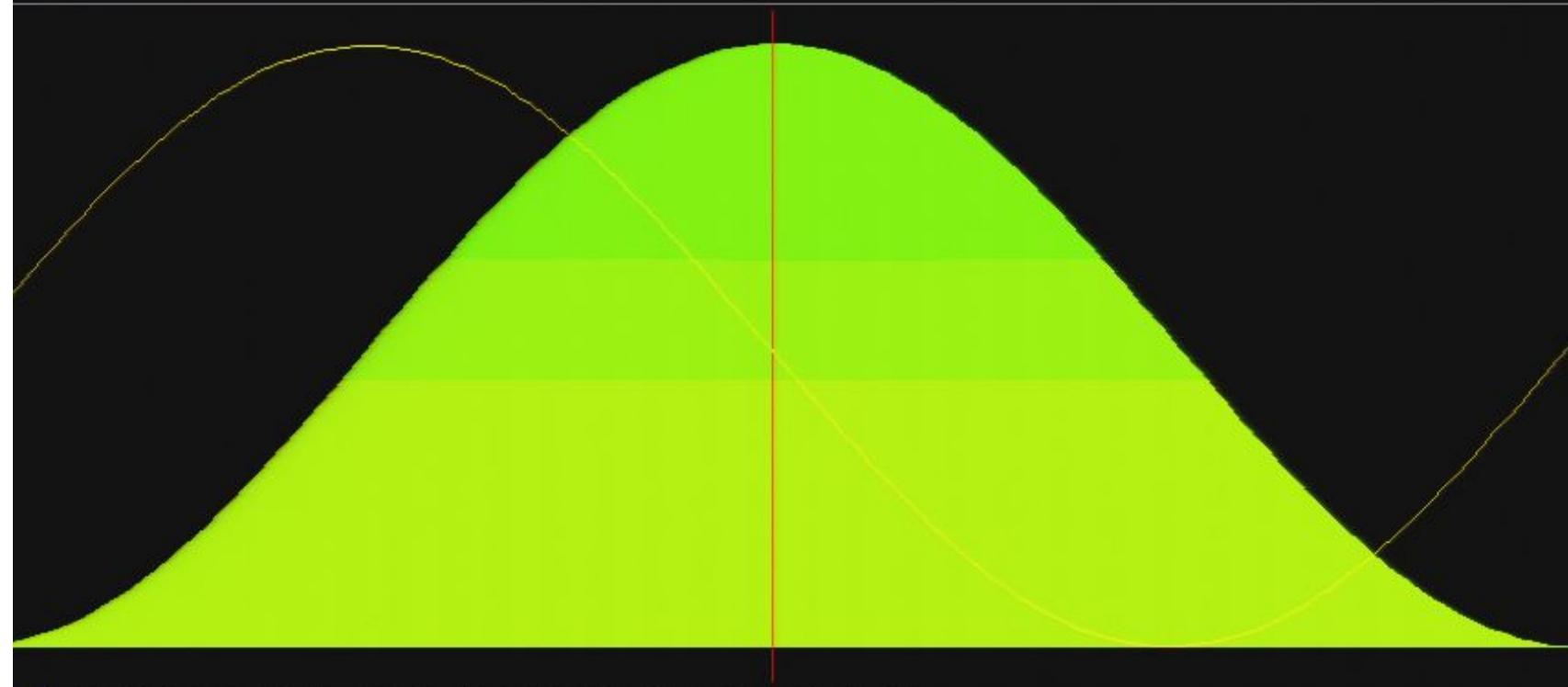
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1-d Quantum Transitions Applet v1.5

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Reverse Phase

Stopped

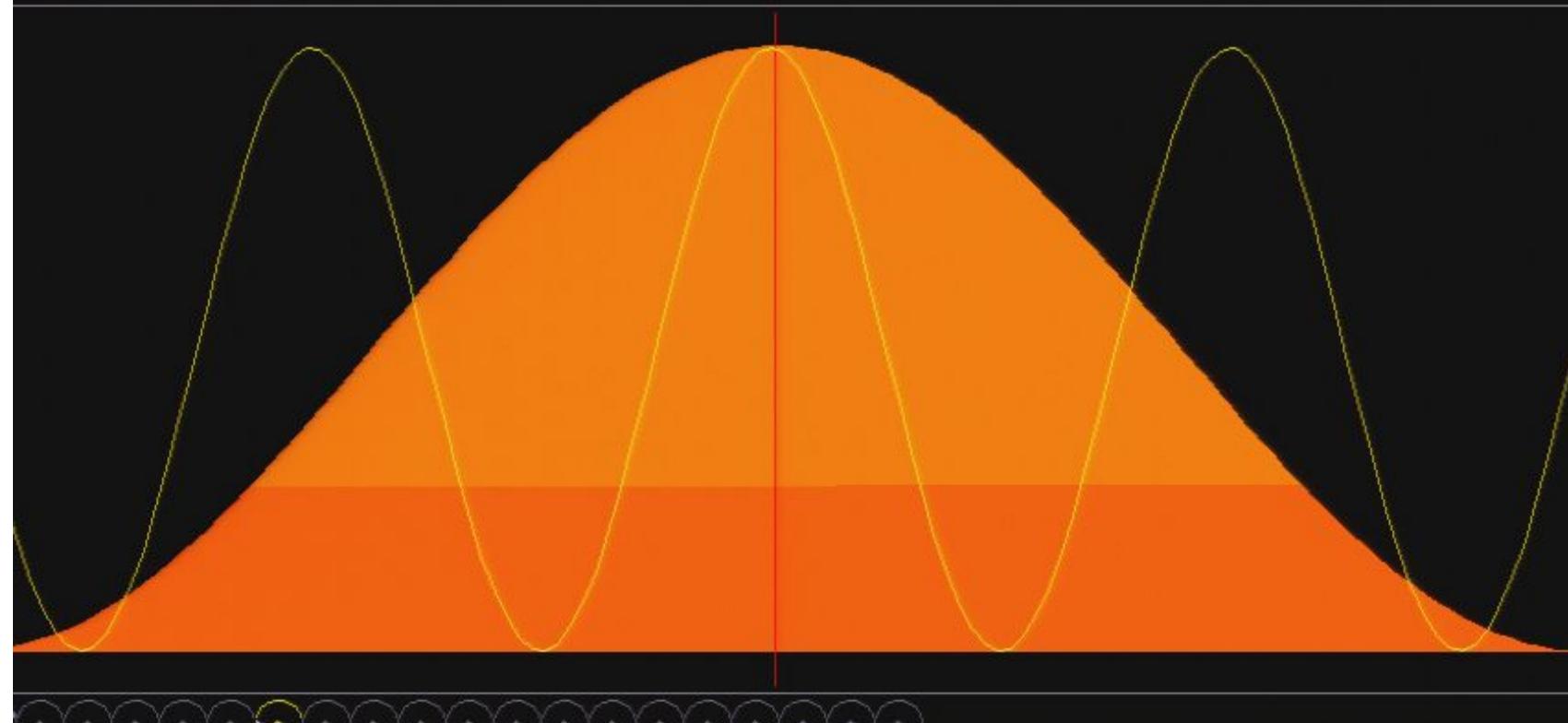
Simulation Speed

Radiation Intensity

Radiation Frequency

Resolution

Electric Field: Current:



1-d Quantum Transitions Applet v1.5

View

Setup: Infinite Well

Clear

Rescale Graphs

Stop Radiation

Reverse Phase

Stopped

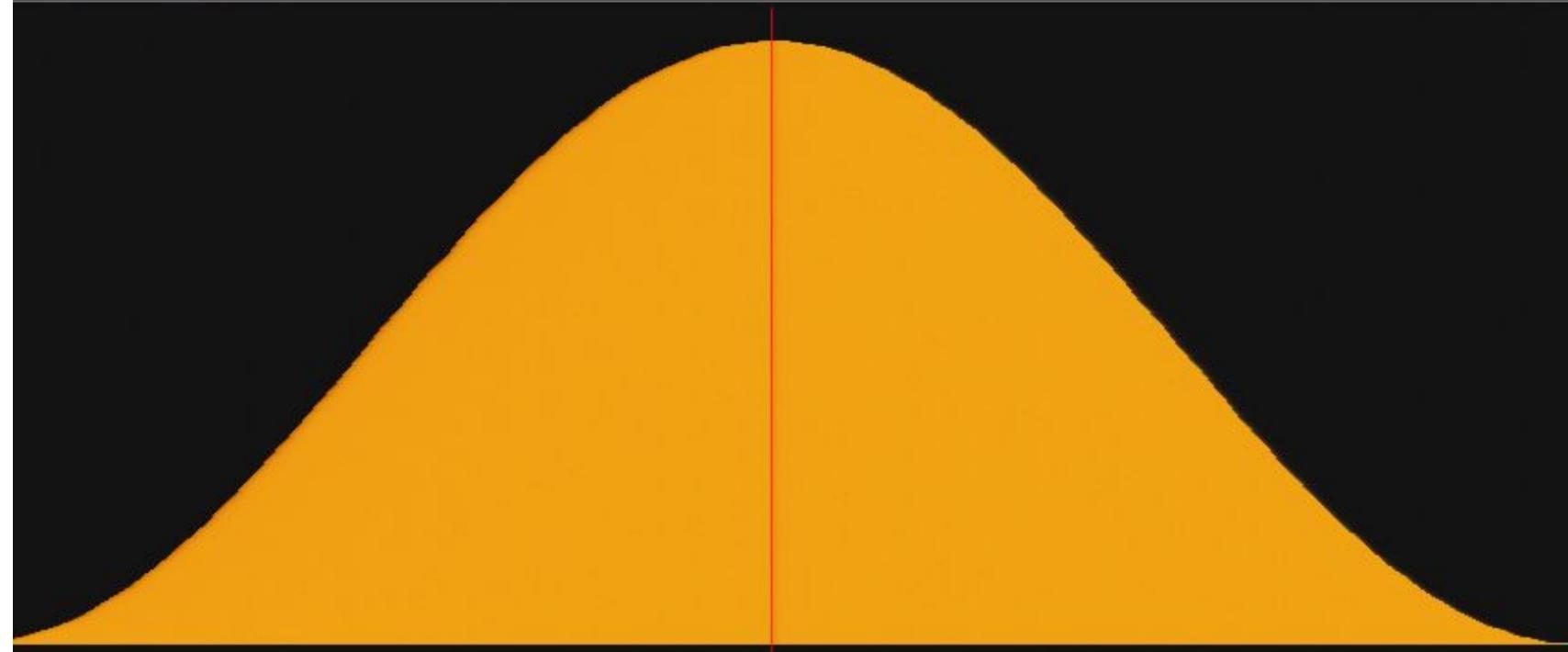
Simulation Speed

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Radiation Frequency

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1-d Quantum Transitions Applet v1.5

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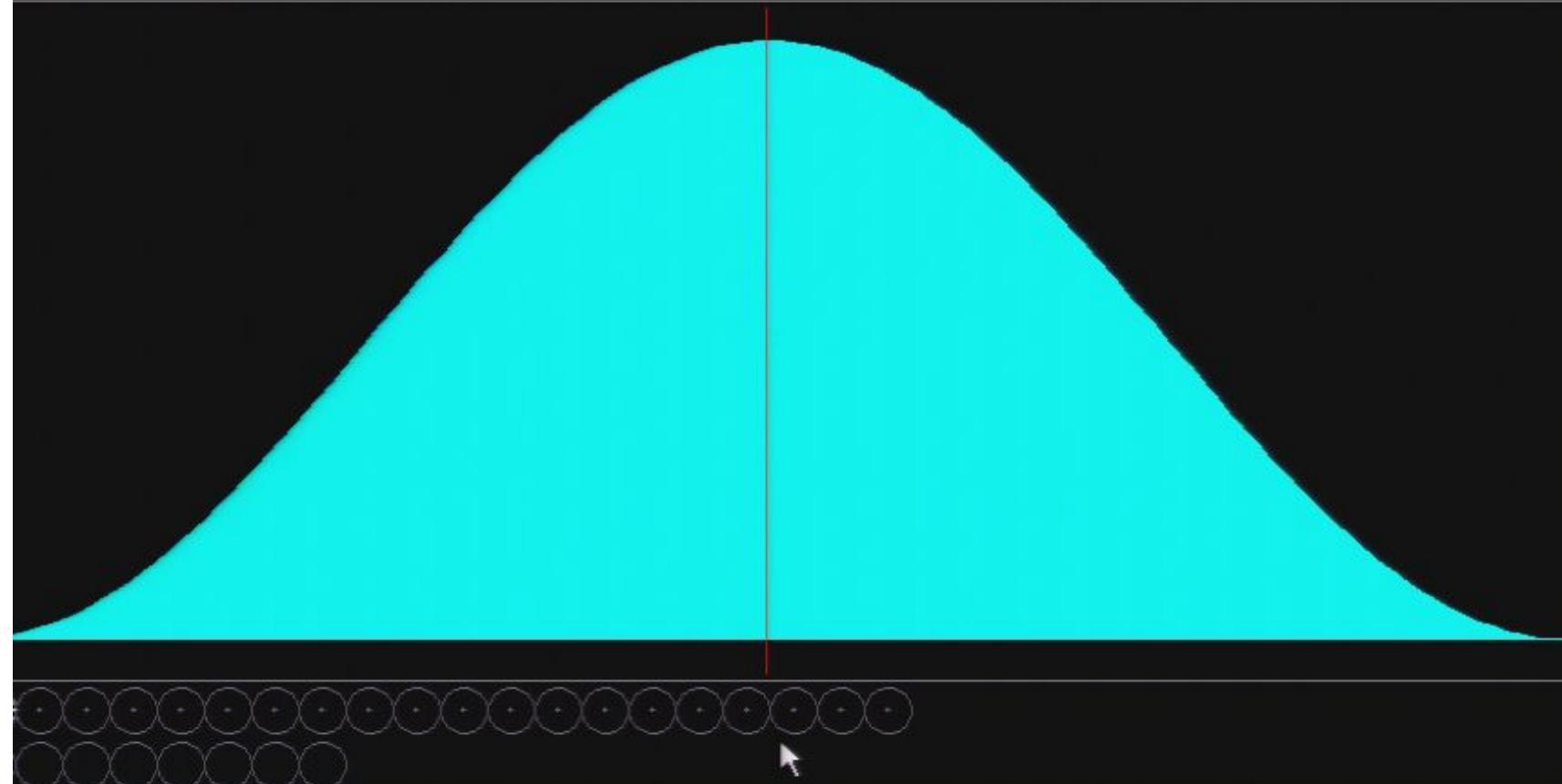
Simulation Speed

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Electric Field: Current:



1-d Quantum Transitions Applet v1.5

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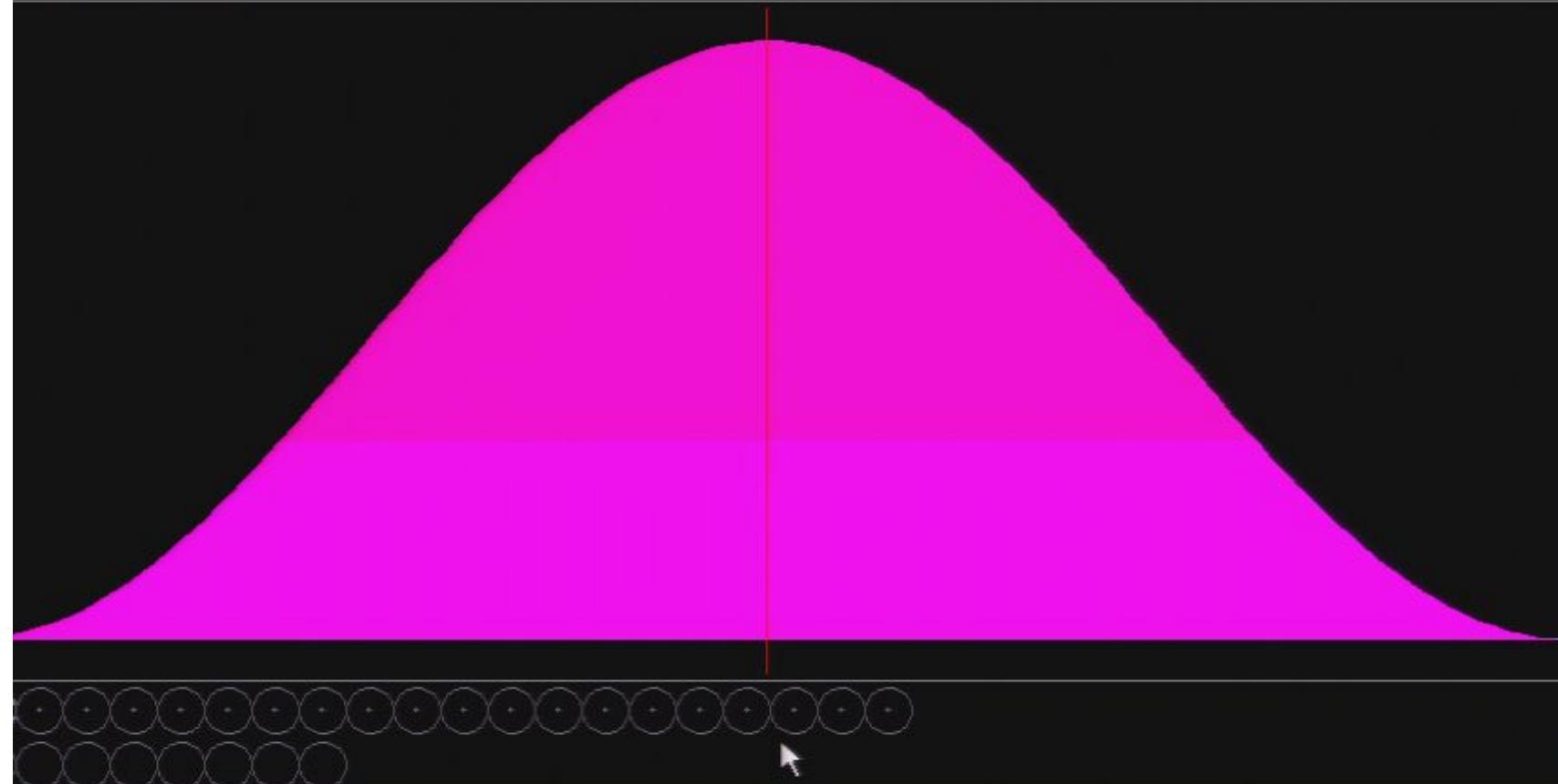
Simulation Speed

Radiation Intensity

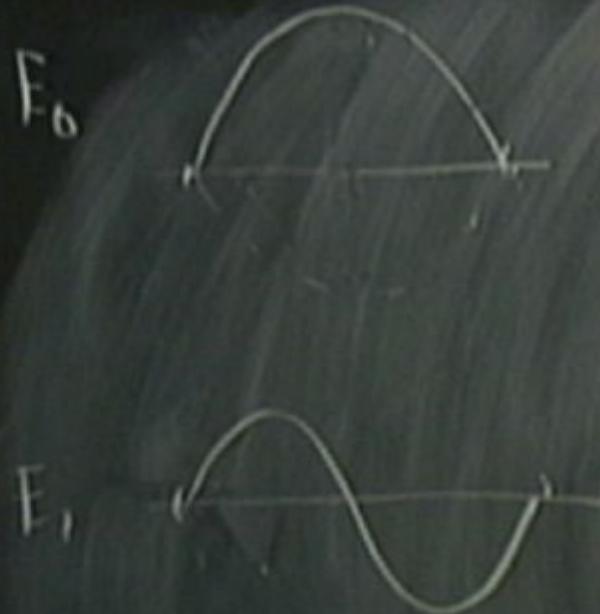
Radiation Frequency

Resolution

Electric Field: Current:



E_0  E_1 



$$E_0 = \Psi_0 \rightarrow |\Psi_0|^2$$

$$E_1$$



$$E_0 = \Psi_0 \rightarrow |\Psi_0|^2 = \rho_0$$
$$E_1$$

1-d Quantum Transitions Applet v1.5

View

Setup: Infinite Well

Clear

Rescale Graphs

Stop Radiation

Reverse Phase

Stopped

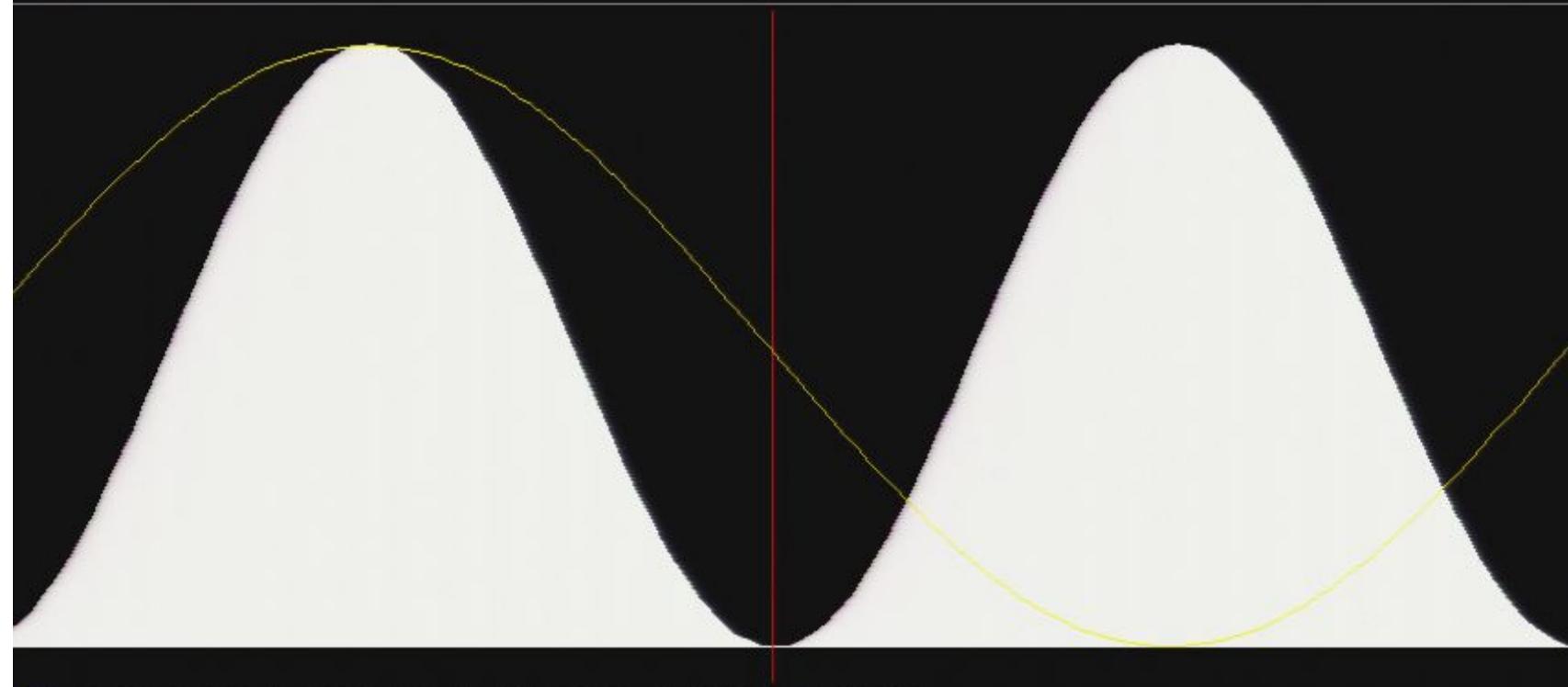
Simulation Speed

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Electric Field: Current:



1-d Quantum Transitions Applet v1.5

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Setup: Infinite Well

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Rescale Graphs

Stop Radiation

Reverse Phase

Stopped

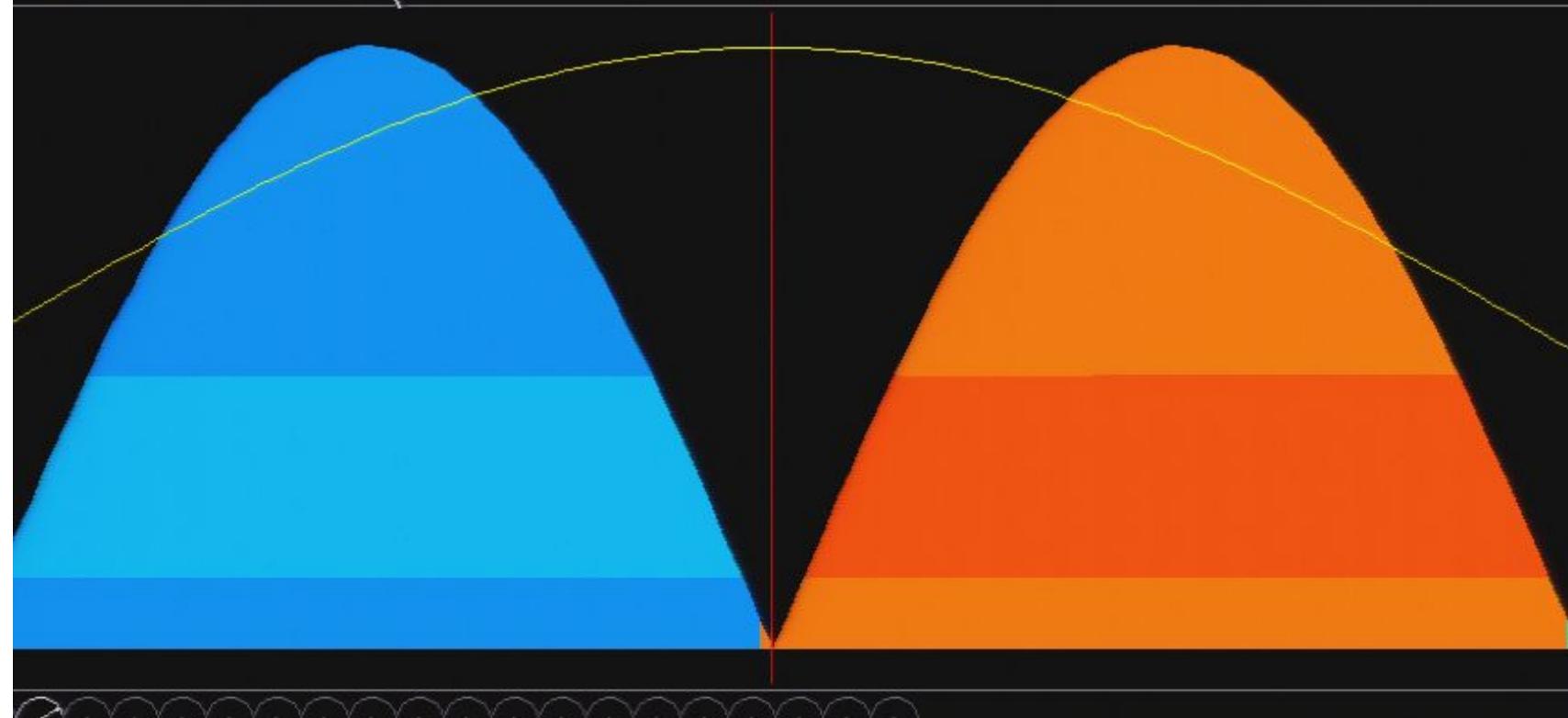
Simulation Speed

Radiation Intensity

Radiation Frequency

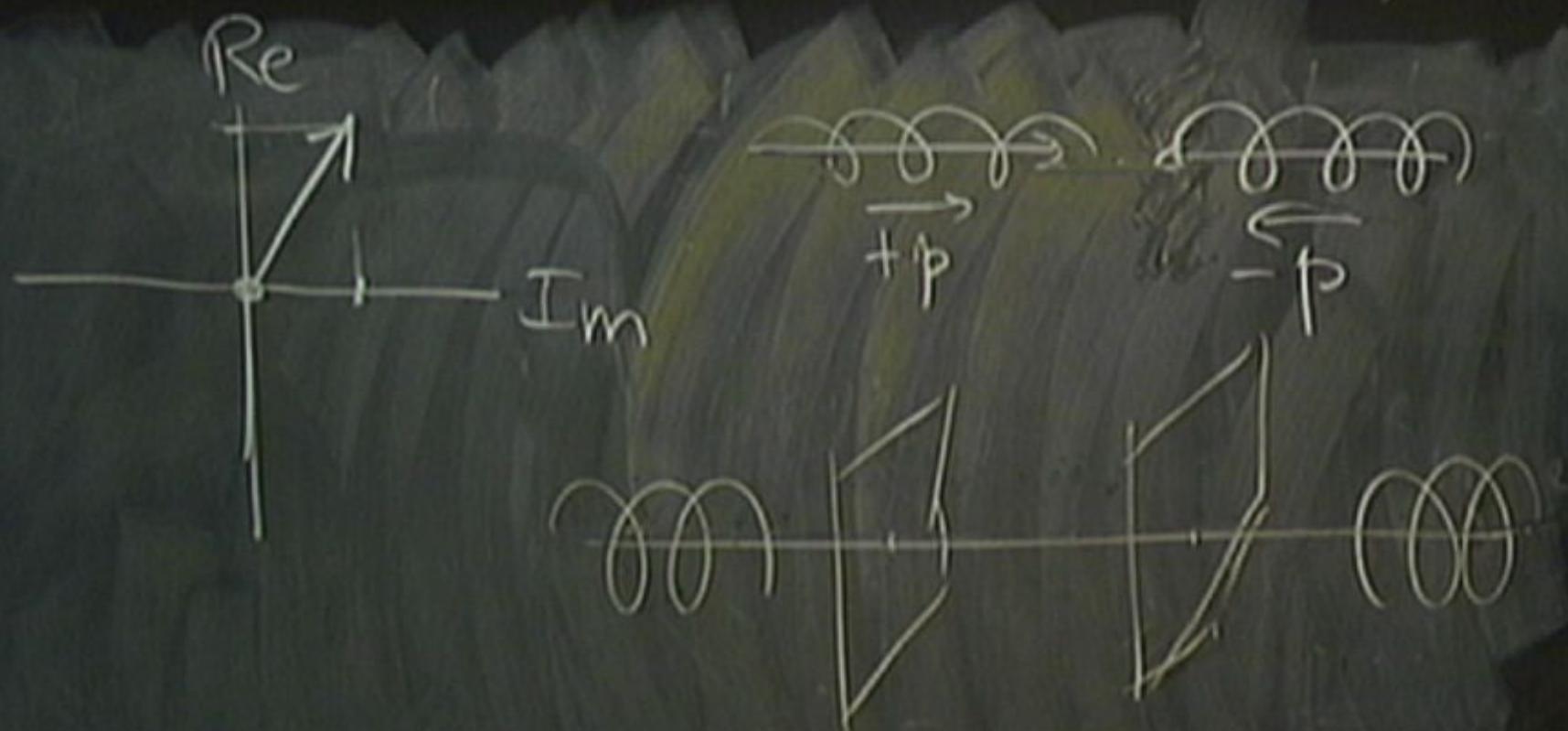
Resolution

Electric Field: Current:



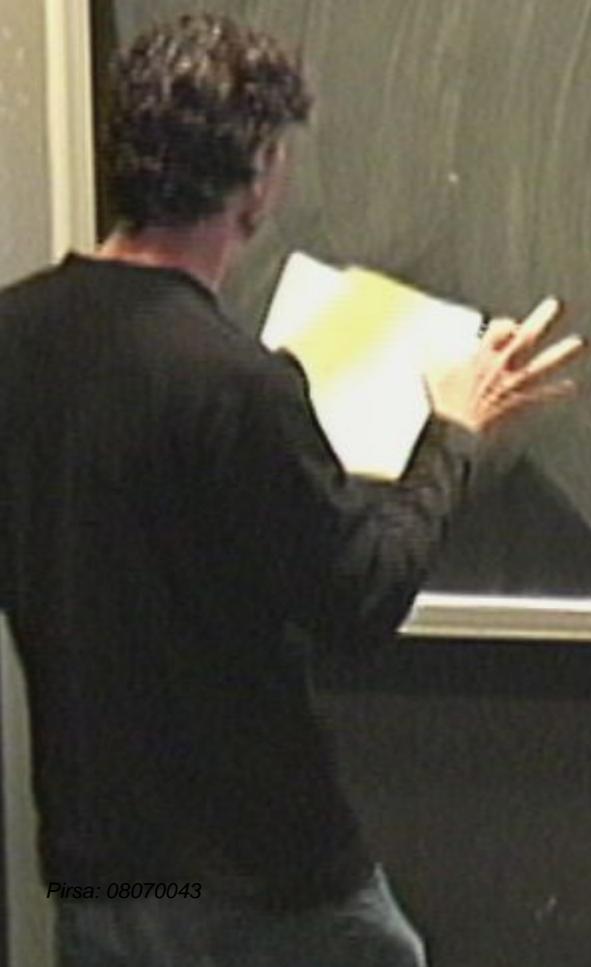
$$E_0 = \Psi_0 \rightarrow |\Psi_0|^2 = P_0$$
$$E_1 = \Psi_1 \rightarrow |\Psi_1|^2 = M$$

$$E_0 = \psi_0 \rightarrow |\psi_0|^2 = P_0$$
$$E_1 = \psi_1 \rightarrow |\psi_1|^2 = P_1$$
$$|\psi_1|^2 \Delta x = \rho v h$$

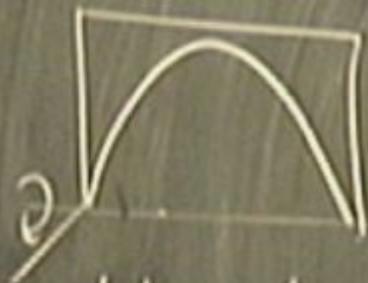


$$\psi_0 = \psi_0^+ - \psi_0^- \quad , \quad |\psi_0|^2 = P_0$$
$$\psi_1 = \psi_1^+ + \psi_1^- \quad , \quad |\psi_1|^2 = P_1$$
$$|\psi_1|^2 \Delta x = p_{\text{prob}}$$

Superposition



Superposition



rotating at

$$f_0 = \frac{E_0}{h}$$

$$\Psi_{\text{tot}} = \Psi_R + \Psi_L$$



rotating at
 $f_o = \frac{E_o}{\hbar}$

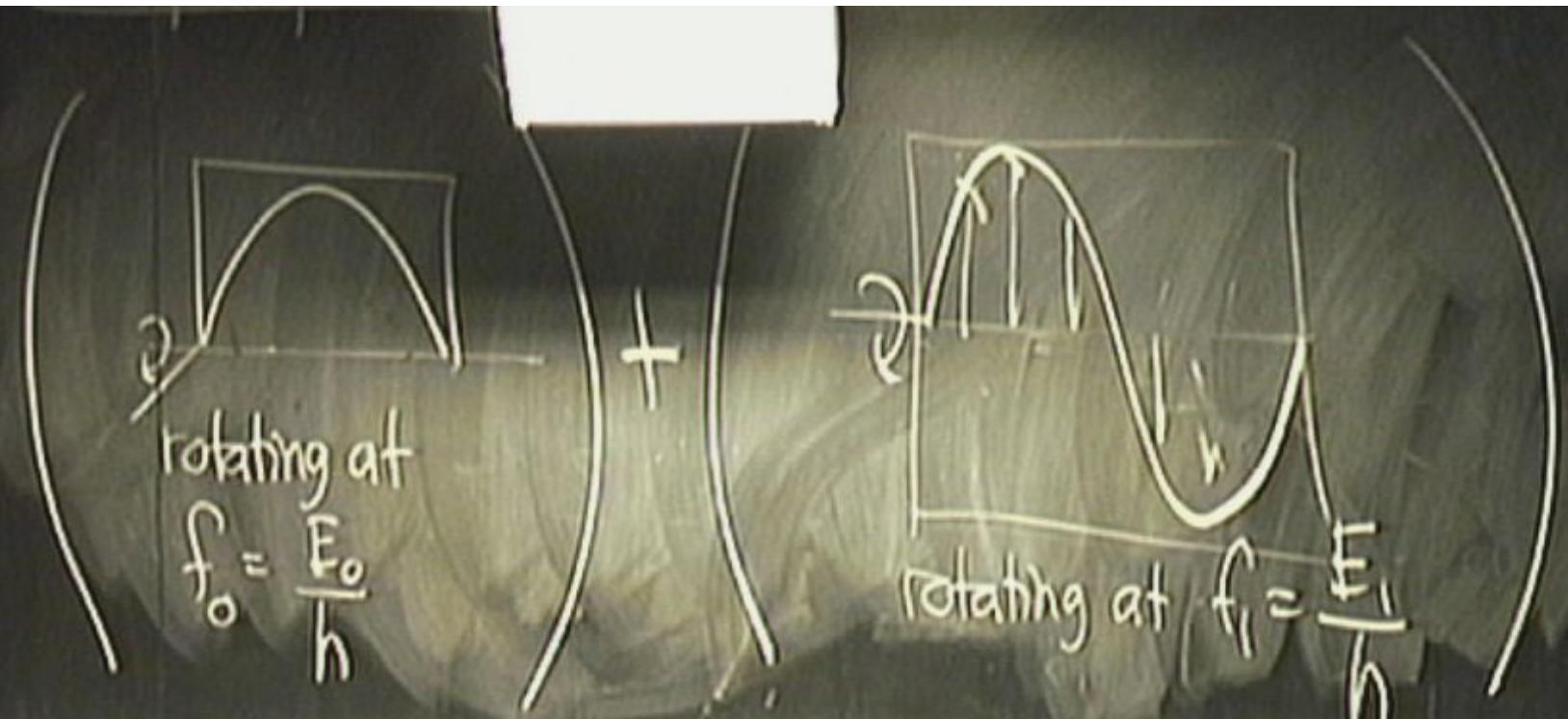
rotating at $f_i = \frac{E_i}{\hbar}$

rotating at
 $f_0 = \frac{E_0}{\hbar}$

rotating at $f_i = \frac{E_i}{\hbar}$

initially :





Initially :



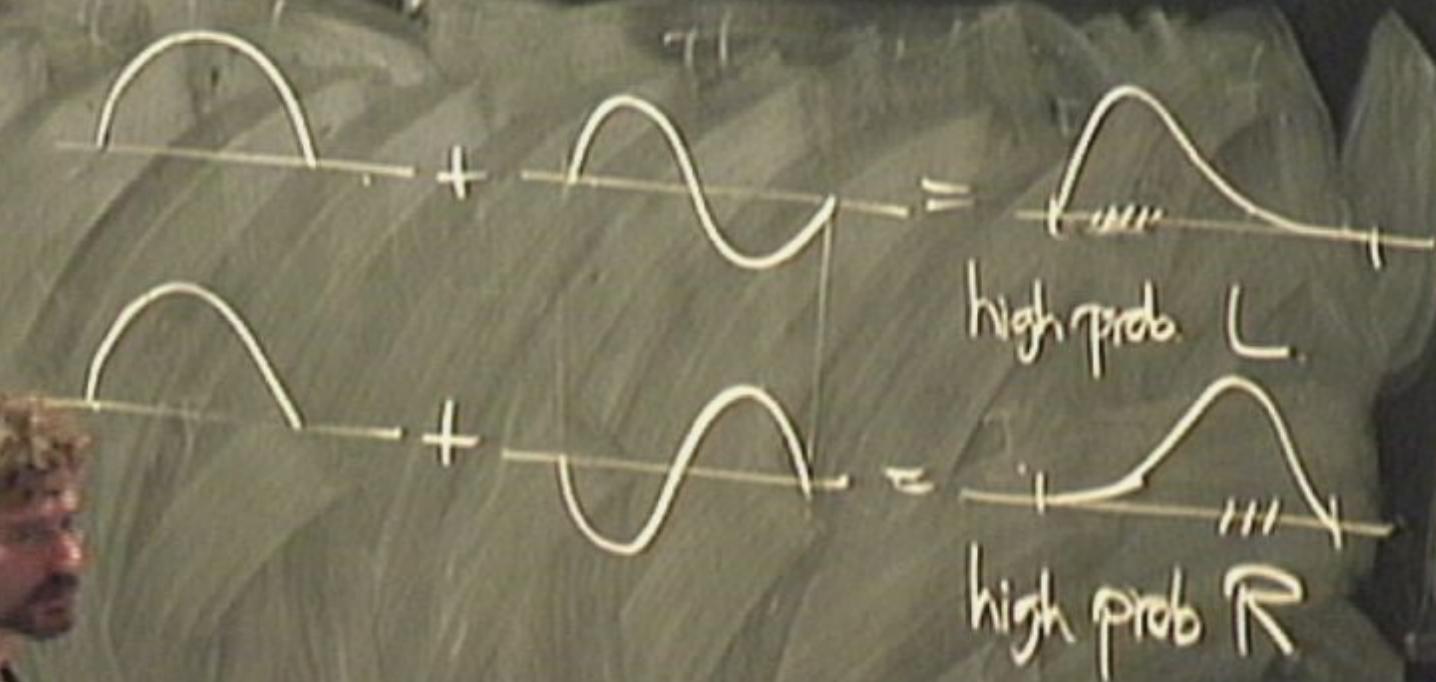
Initially :

$$\text{initial state} + \text{perturbation} = \text{final state}$$

high prob. L.

Initially :

later:



1-d Quantum Transitions Applet v1.5

View

Setup: Infinite Well

Clear

Rescale Graphs

Stop Radiation

Reverse Phase

Stopped

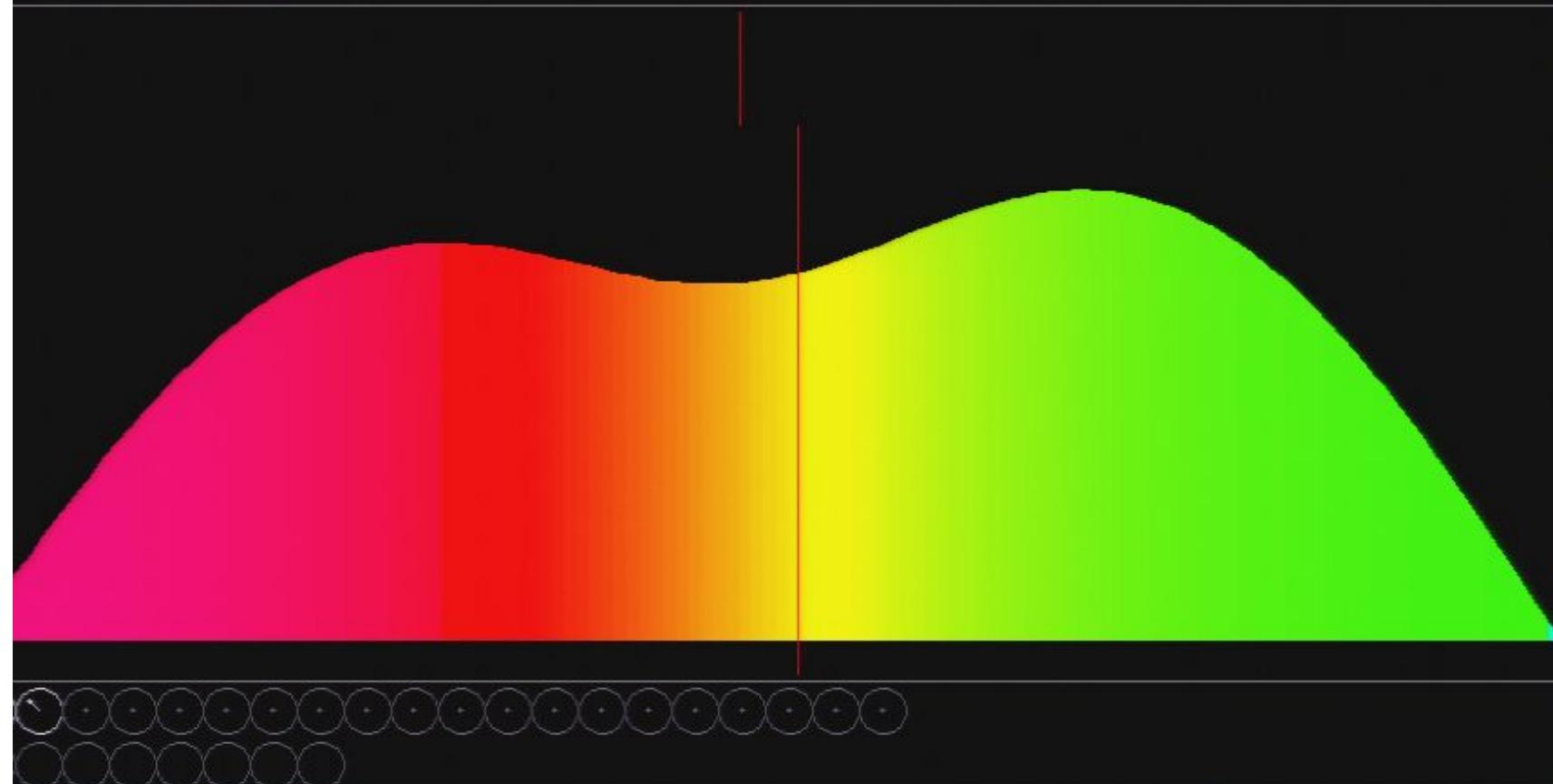
Simulation Speed

Radiation Intensity

Radiation Frequency

Resolution

Electric Field: Current: 



1-d Quantum Transitions Applet v1.5

View

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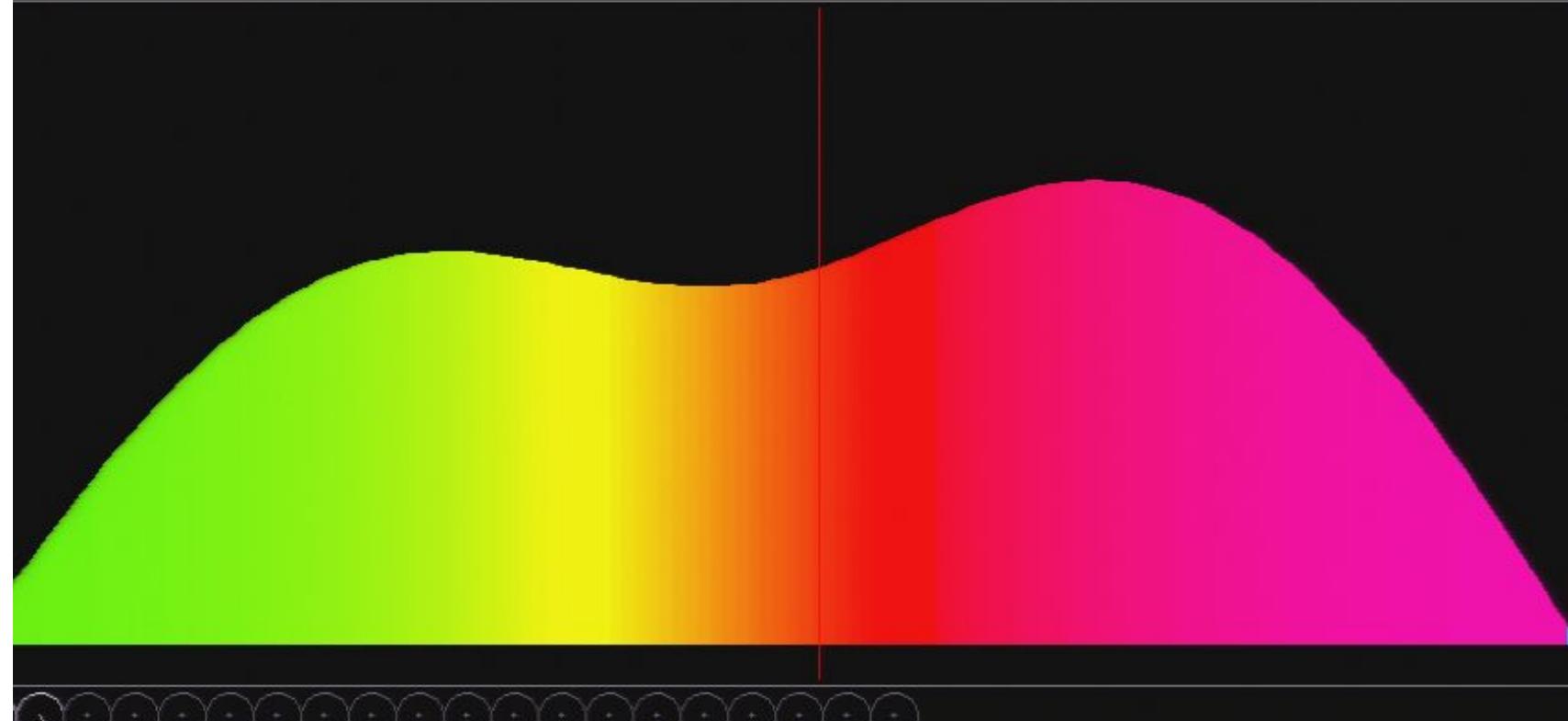
Simulation Speed

Radiation Intensity

Radiation Frequency

Resolution

Electric Field: Current: ←



1-d Quantum Transitions Applet v1.5

View

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Stop Radiation

Reverse Phase

Stopped

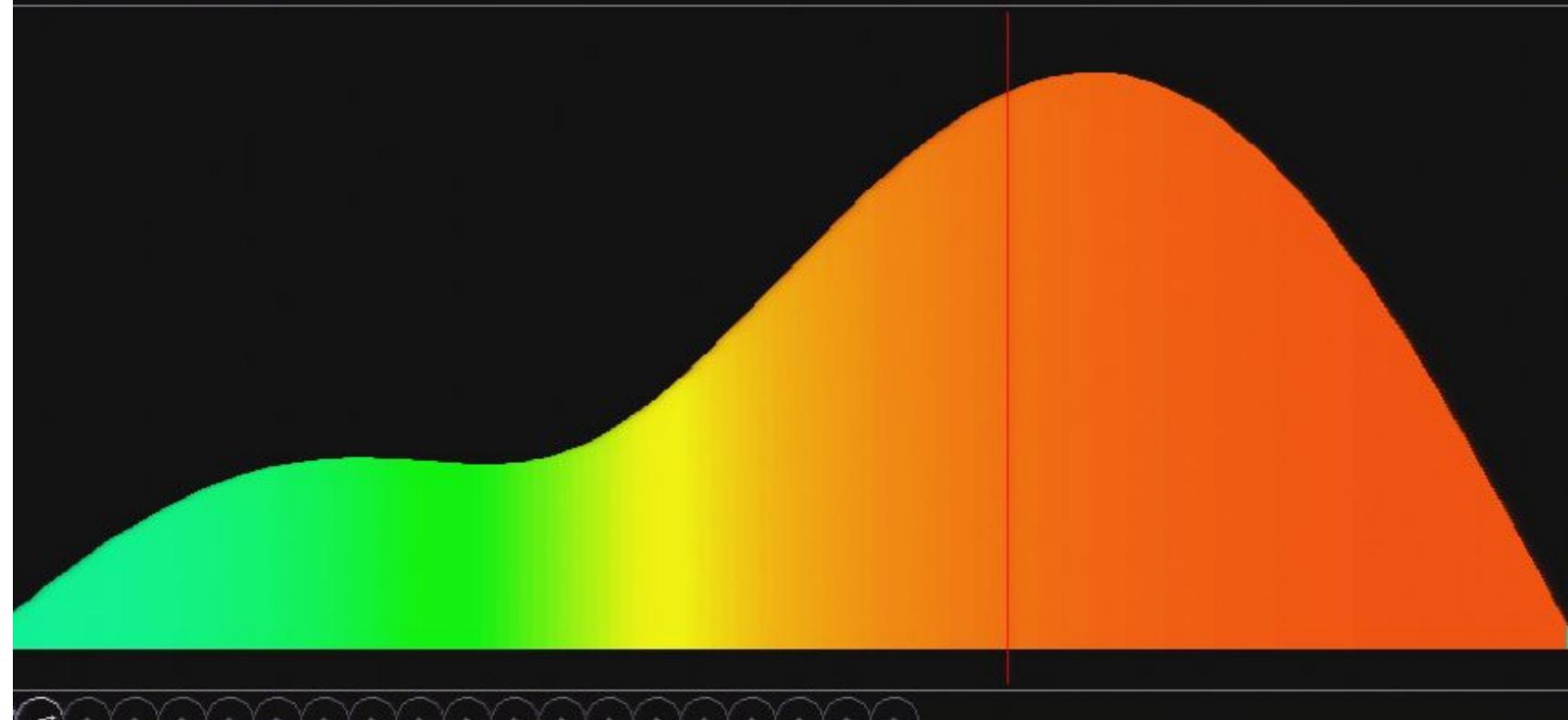
Simulation Speed

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Radiation Frequency

Resolution

Electric Field: Current: ←



1-d Quantum Transitions Applet v1.5

View

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Rescale Graphs

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Reverse Phase

Stopped

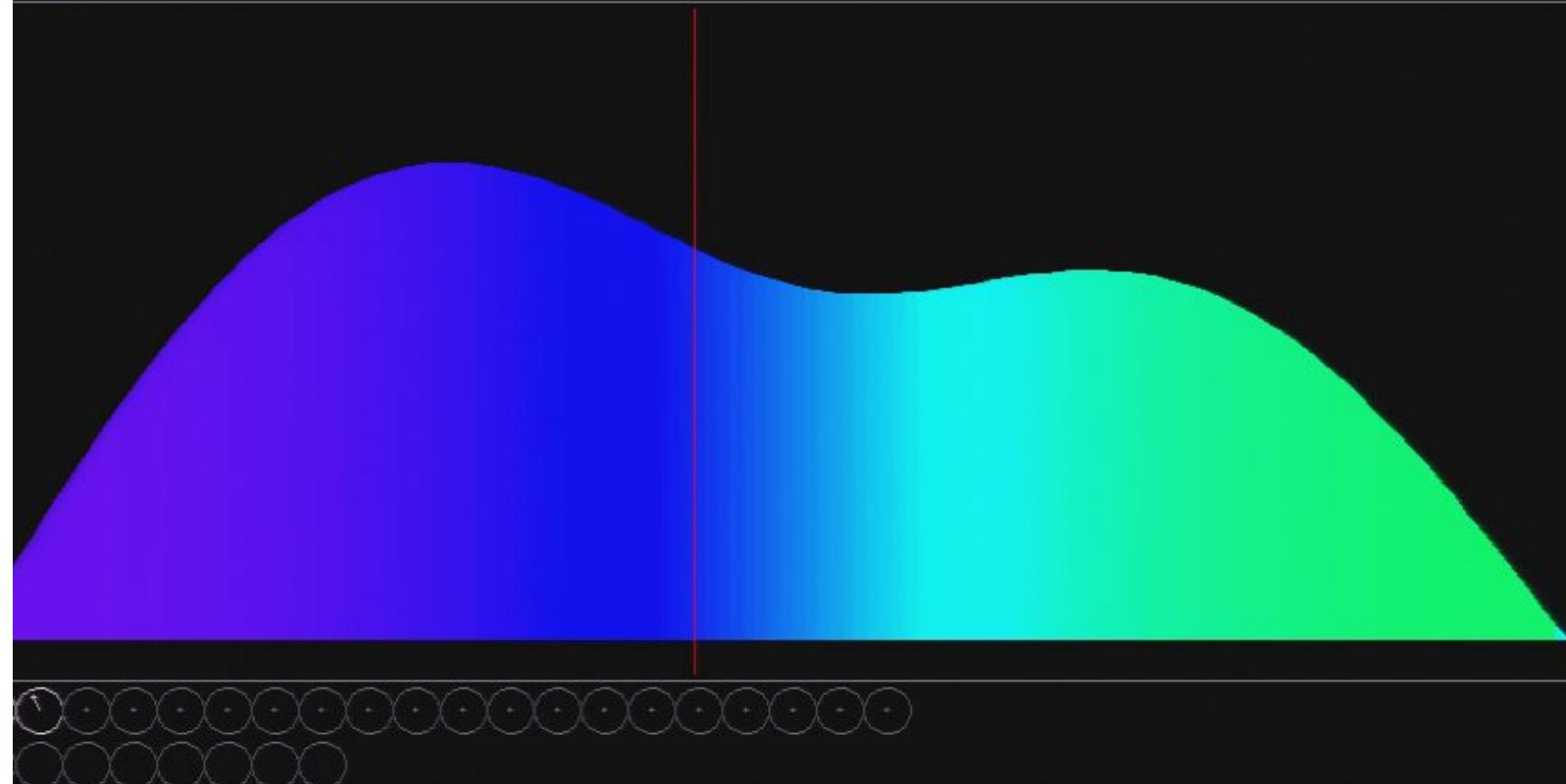
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1-d Quantum Transitions Applet v1.5

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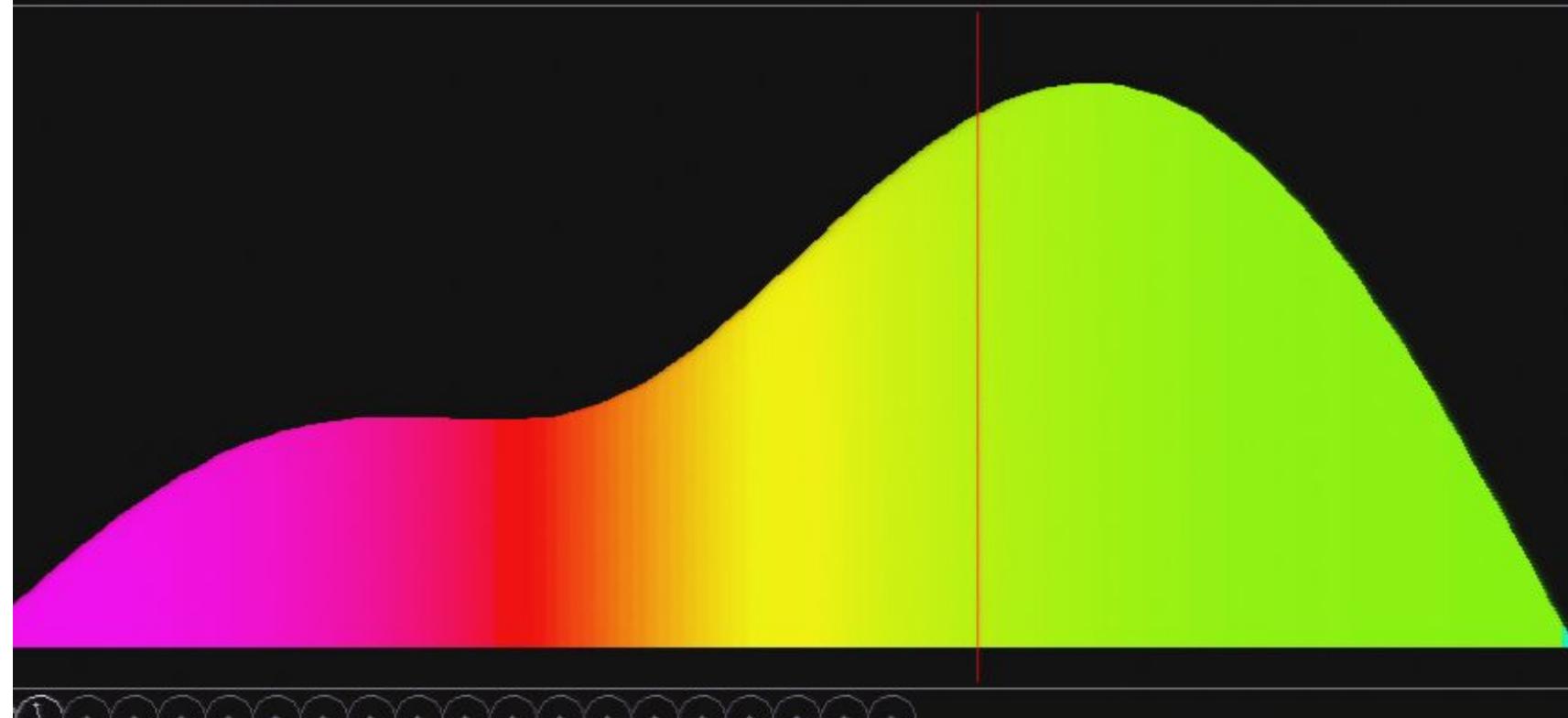
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Radiation Frequency

Resolution

Electric Field: Current: →



1-d Quantum Transitions Applet v1.5

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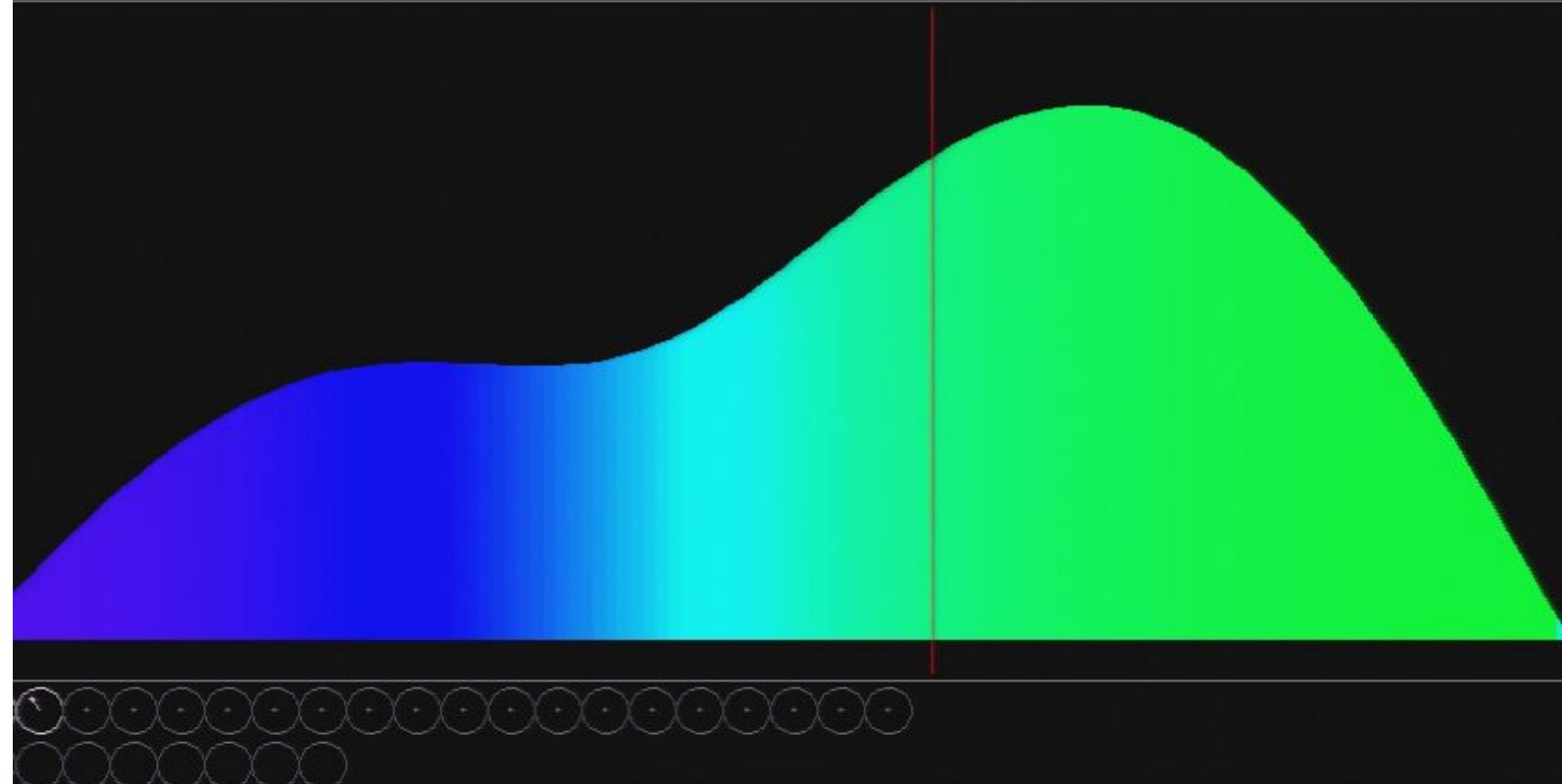
Simulation Speed

Radiation Intensity

Radiation Frequency

Resolution

Electric Field: Current: ←



1-d Quantum Transitions Applet v1.5

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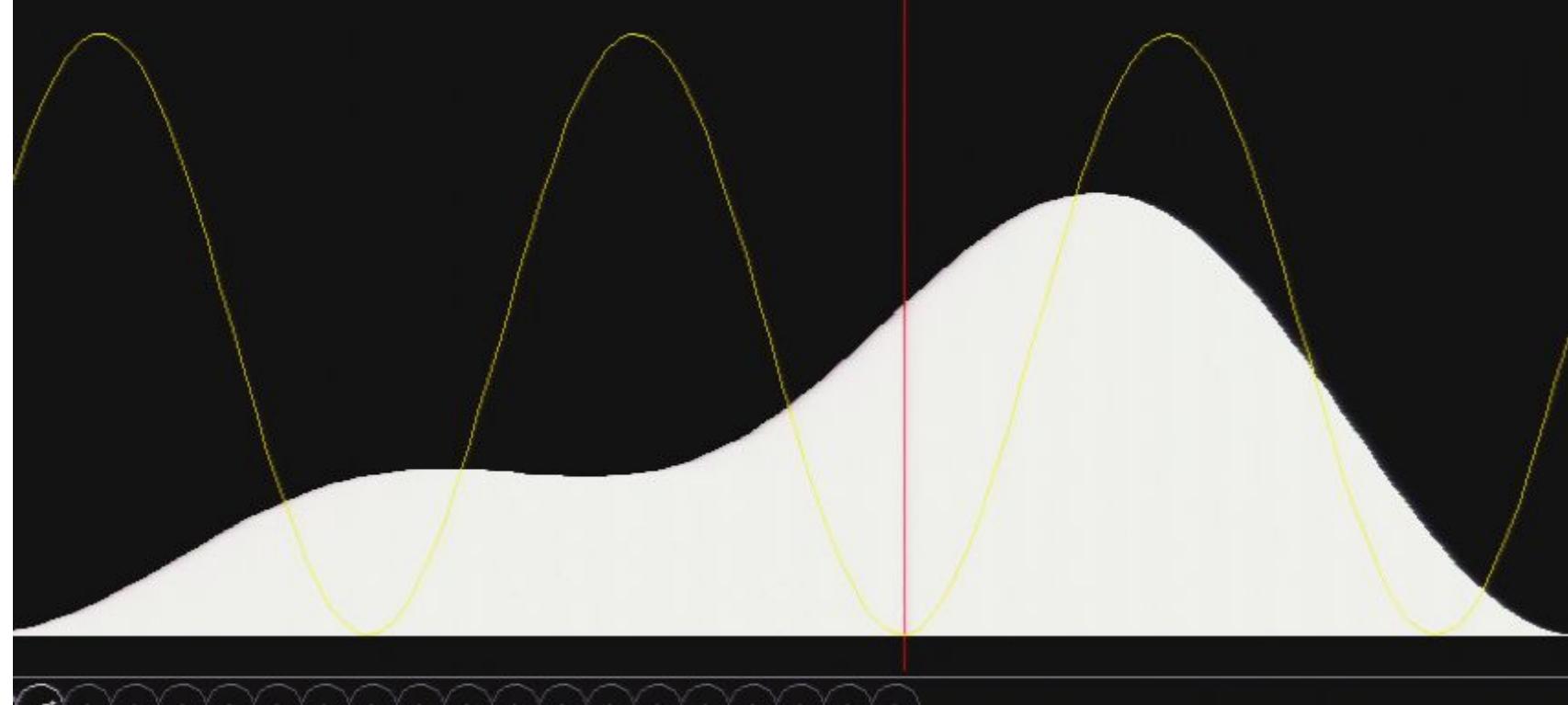
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Electric Field: Current:



1-d Quantum Transitions Applet v1.5

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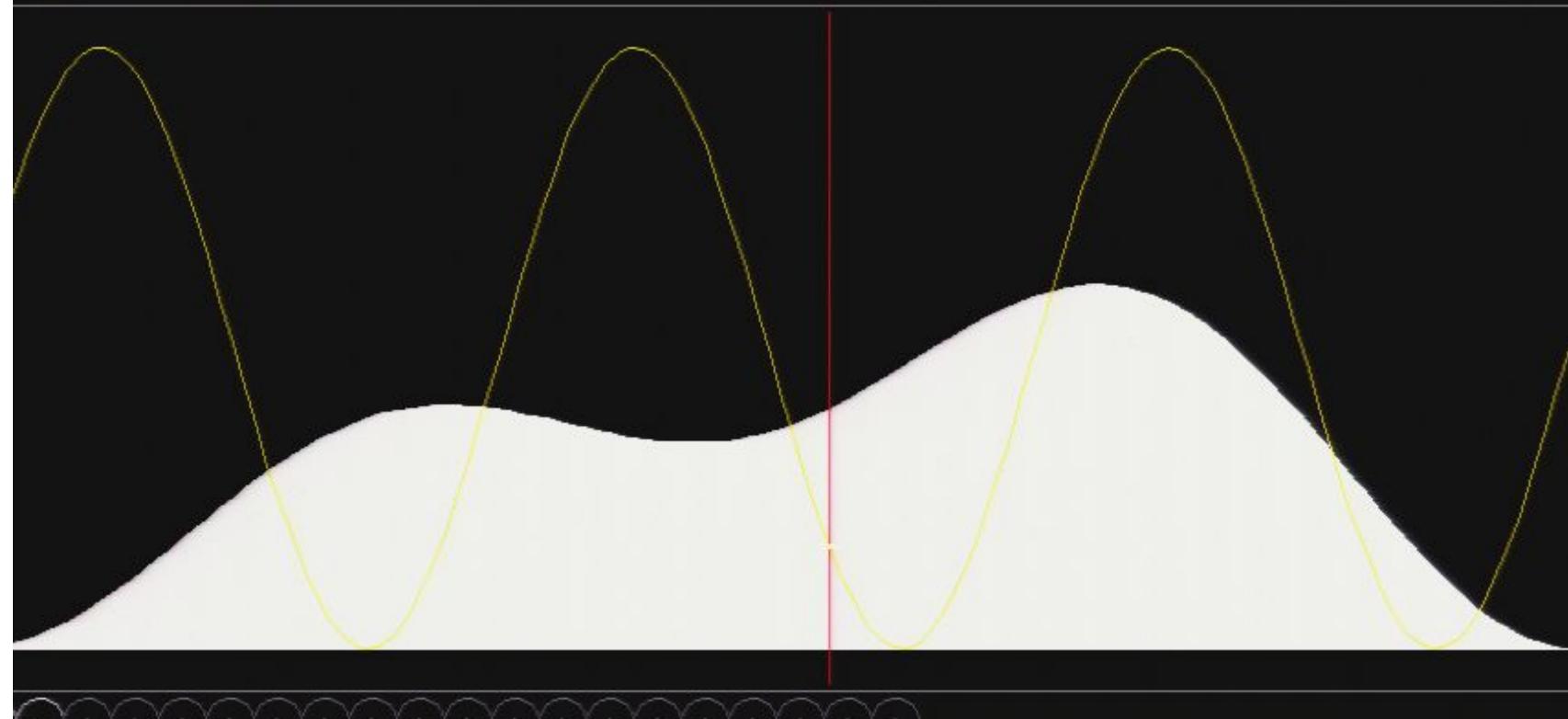
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Radiation Intensity

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Electric Field: Current ←



1-d Quantum Transitions Applet v1.5

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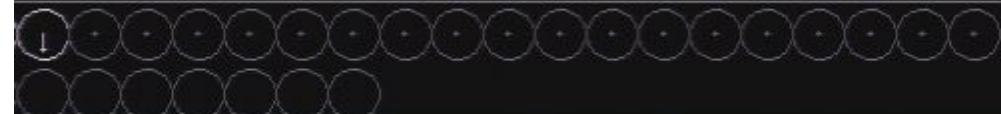
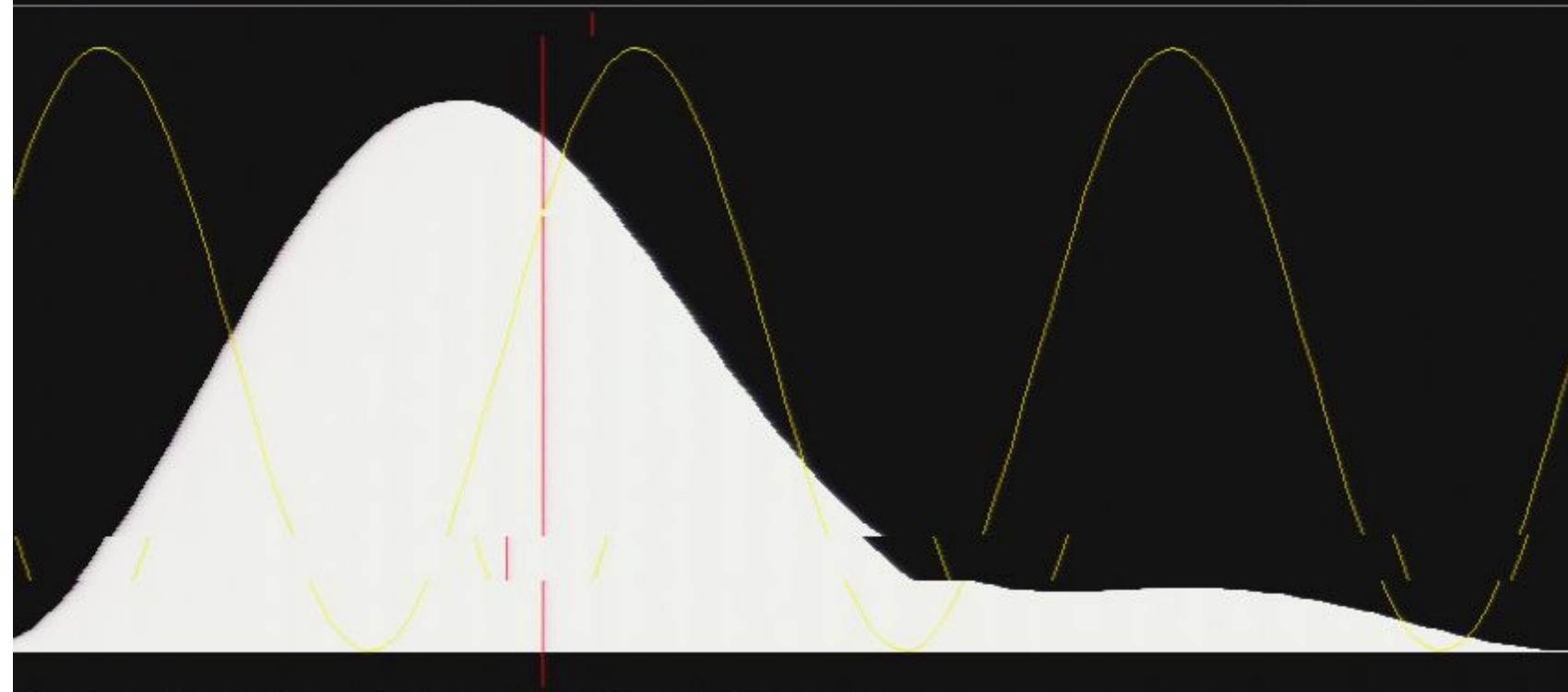
Simulation Speed

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1-d Quantum Transitions Applet v1.5

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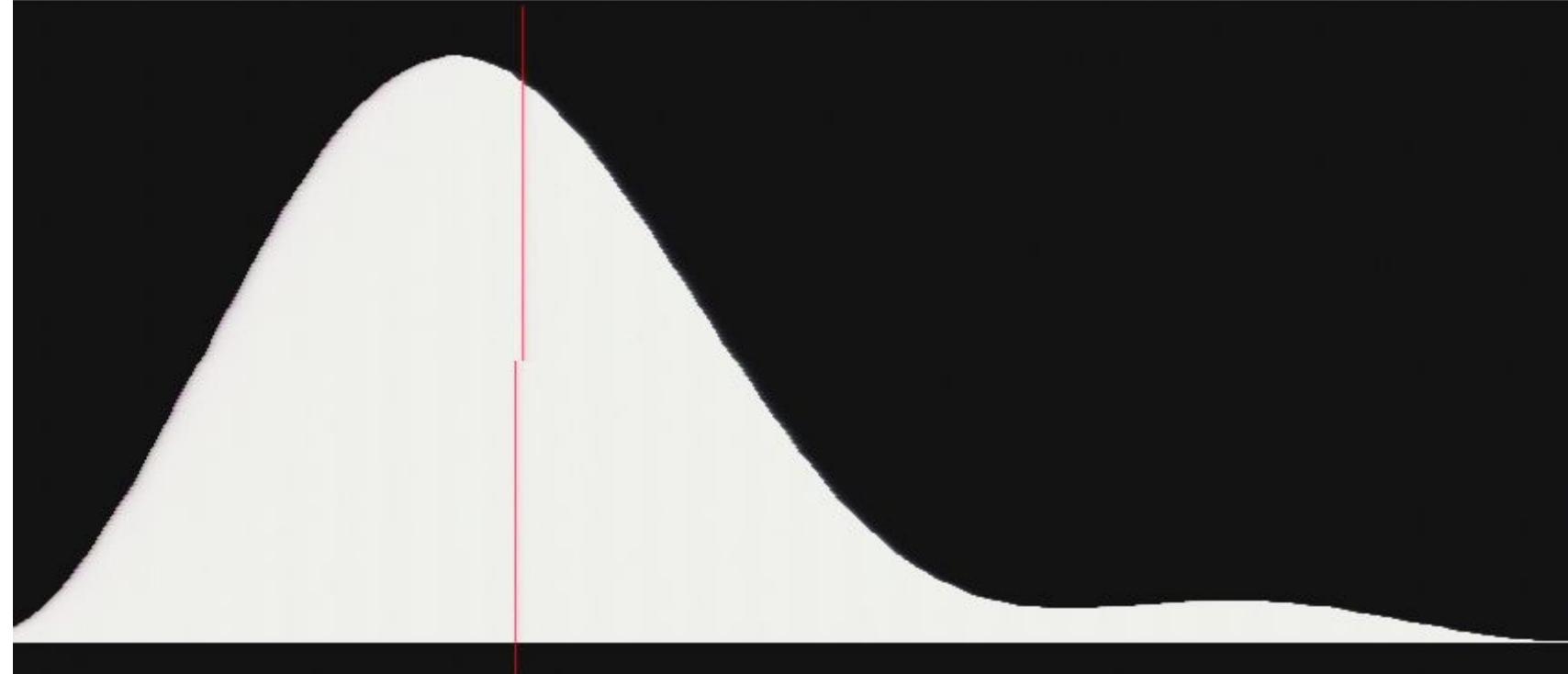
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1-d Quantum Transitions Applet v1.5

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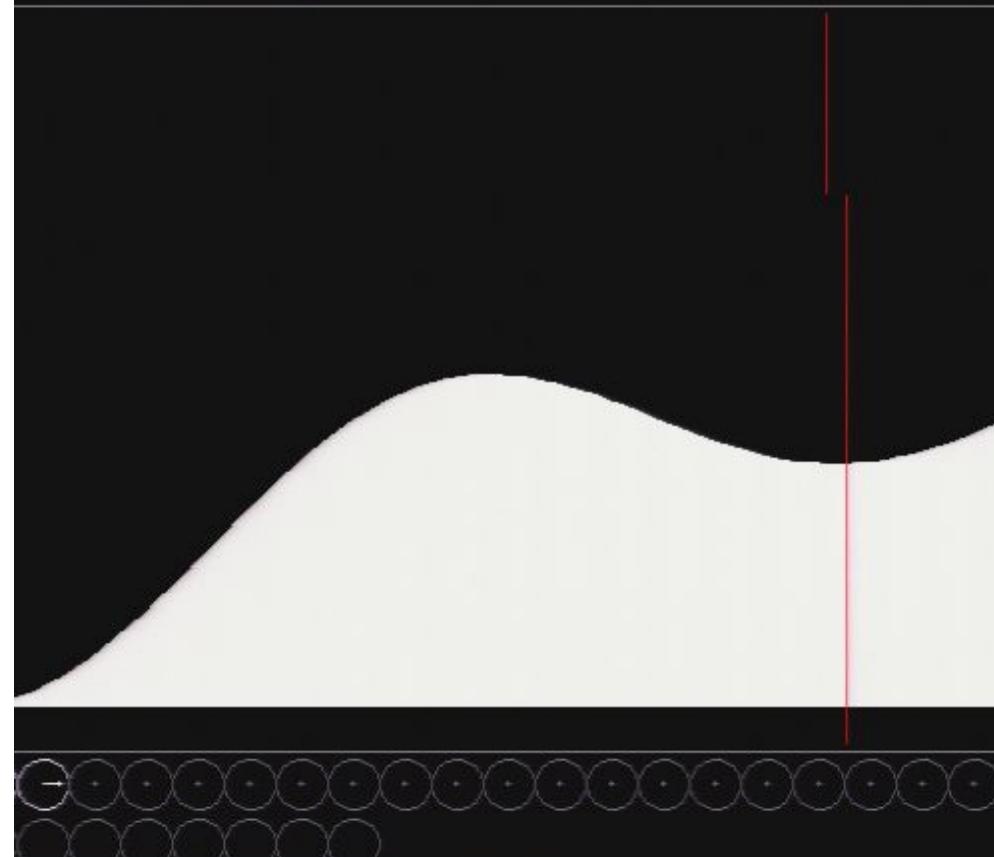
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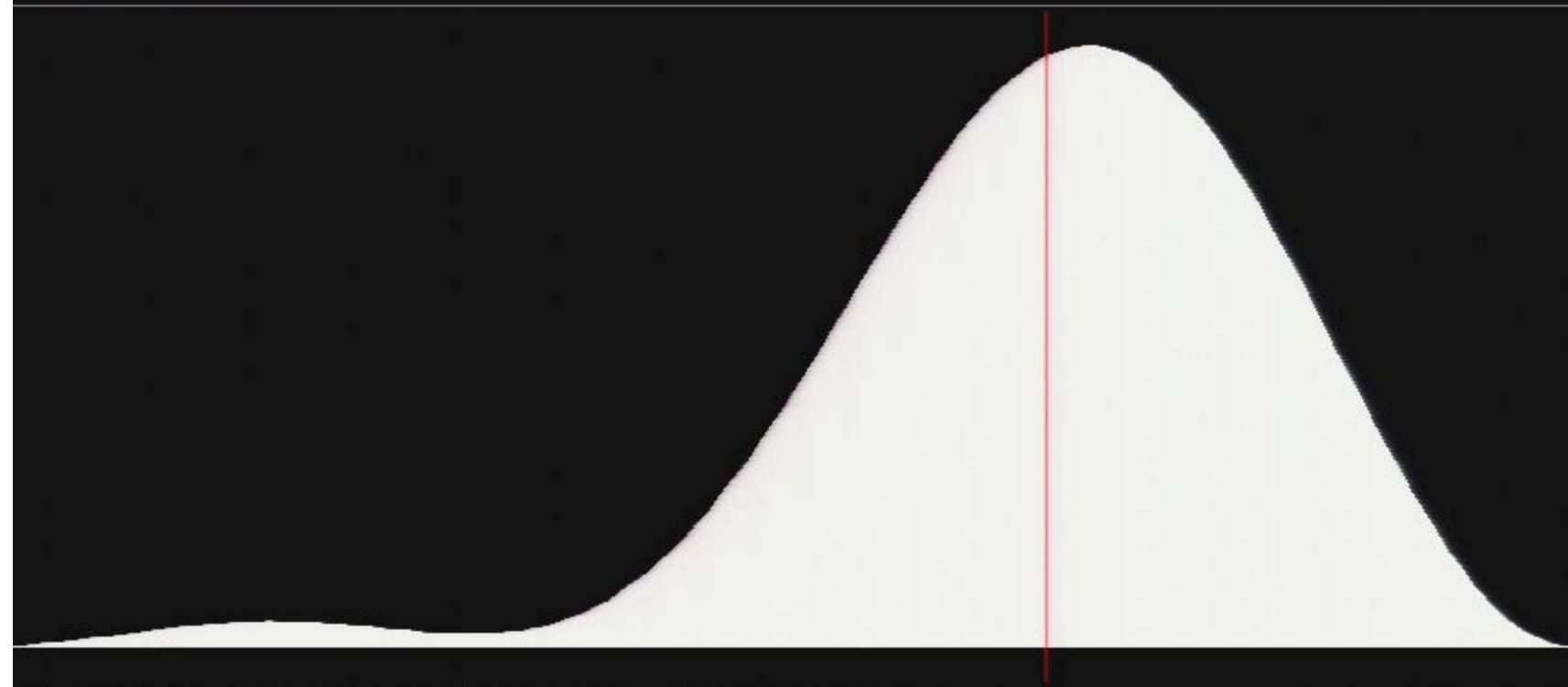
Simulation Speed

Radiation Intensity

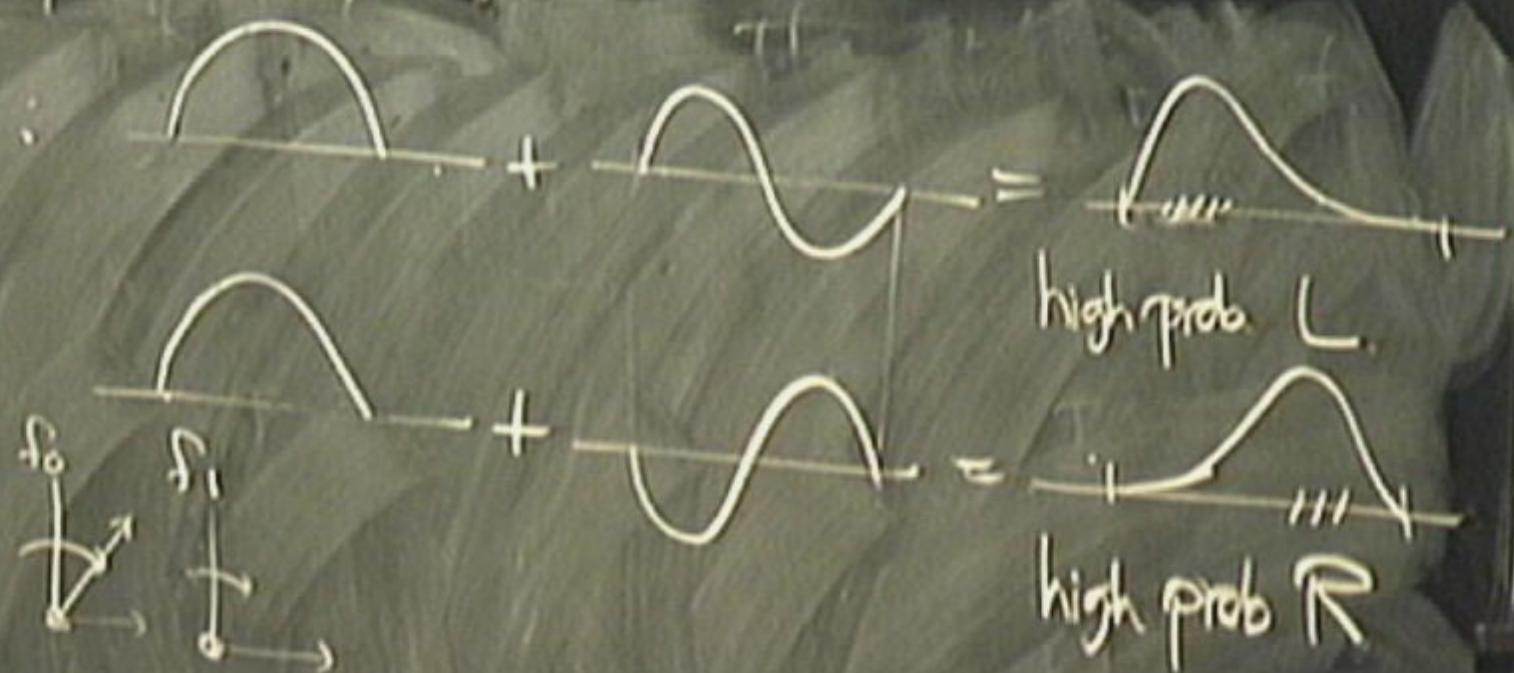
Radiation Frequency

Resolution

Electric Field: Current:



Initially :



$$f = f_i - f_o = \frac{E_i}{\hbar} - \frac{E_o}{\hbar} = \frac{E_i - E_o}{\hbar} = \frac{\Delta E}{\hbar}$$



$$f = f_1 - f_0 = \frac{E_1}{h} - \frac{E_0}{h} = \frac{E_1 - E_0}{h} = \frac{\Delta E}{h}$$

T E₂

E₁

E₀

1-d Quantum Transitions Applet v1.5

View

Setup: Infinite Well

Clear

Rescale Graphs

Stop Radiation

Reverse Phase

Stopped

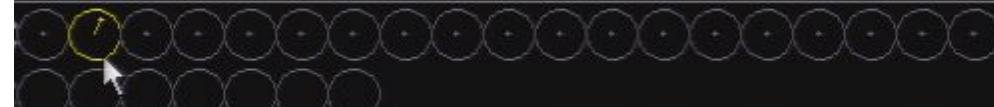
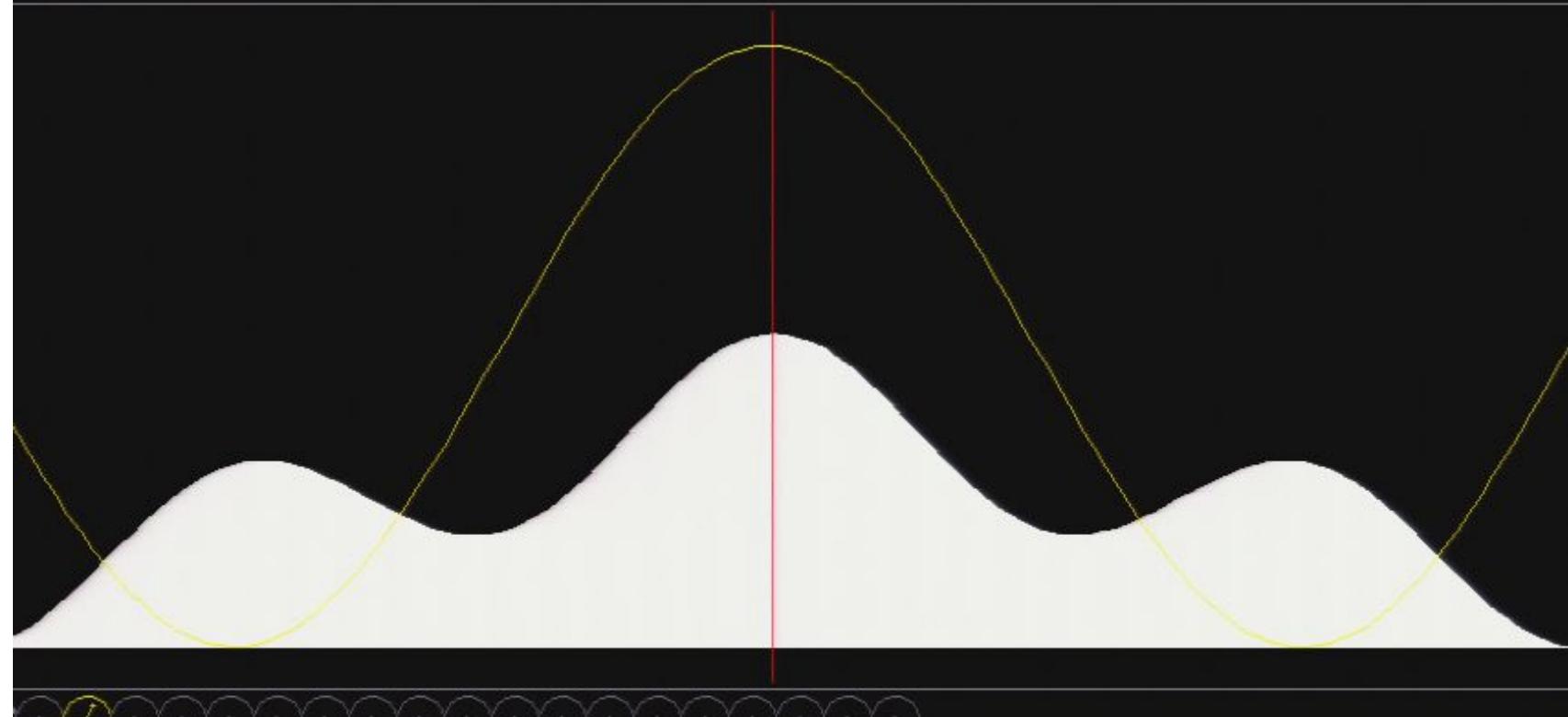
Simulation Speed

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Electric Field: Current:



1-d Quantum Transitions Applet v1.5

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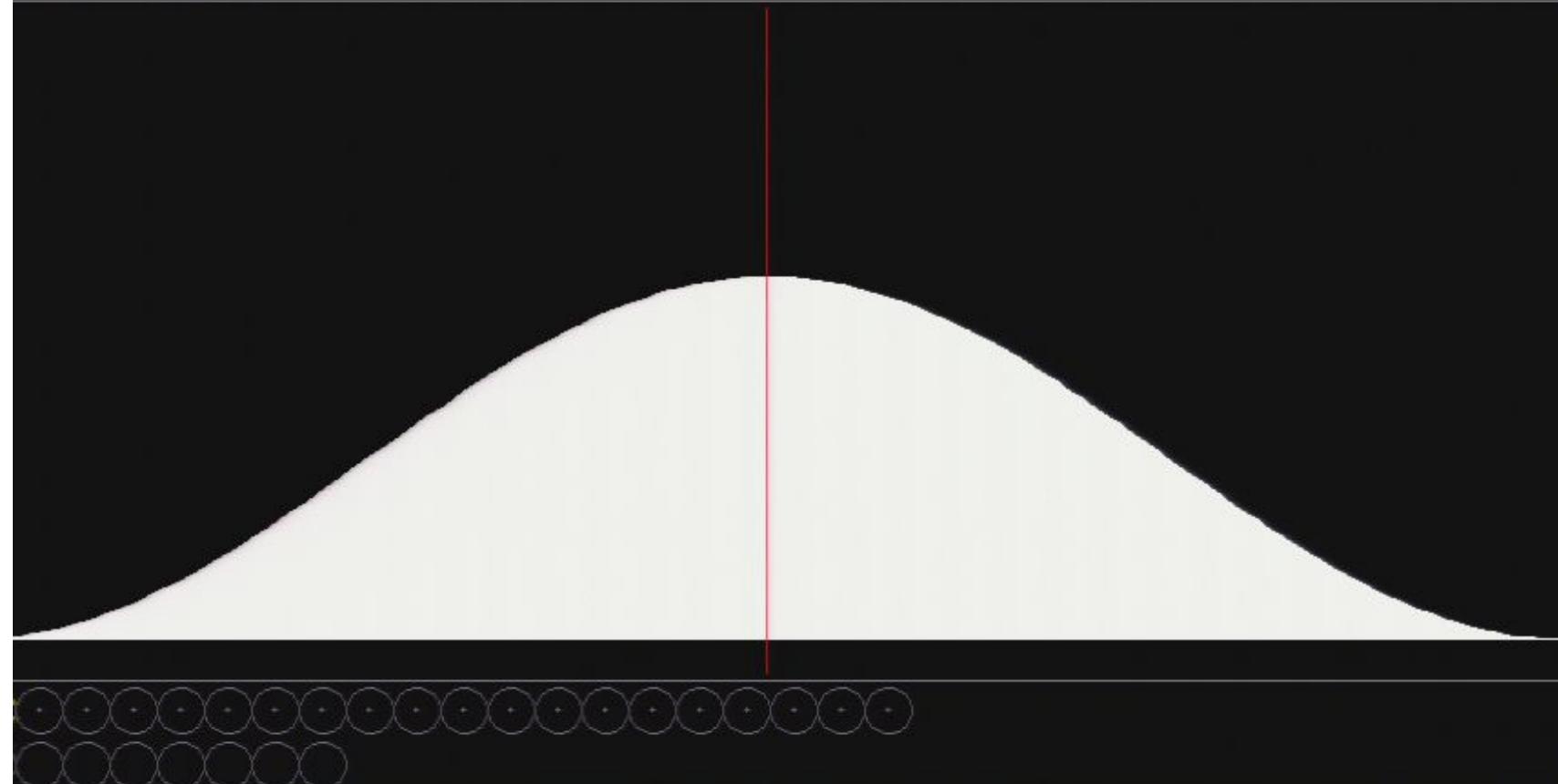
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1-d Quantum Transitions Applet v1.5

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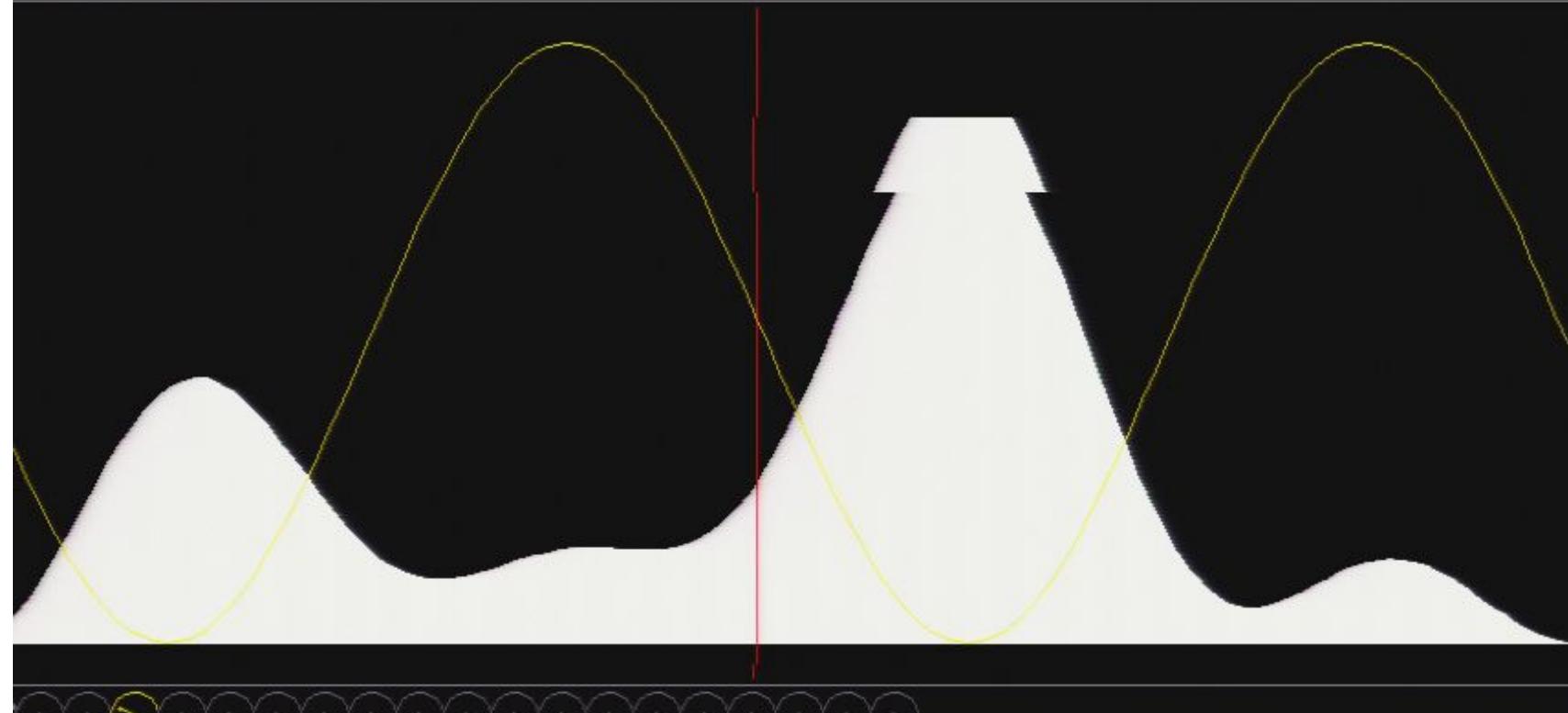
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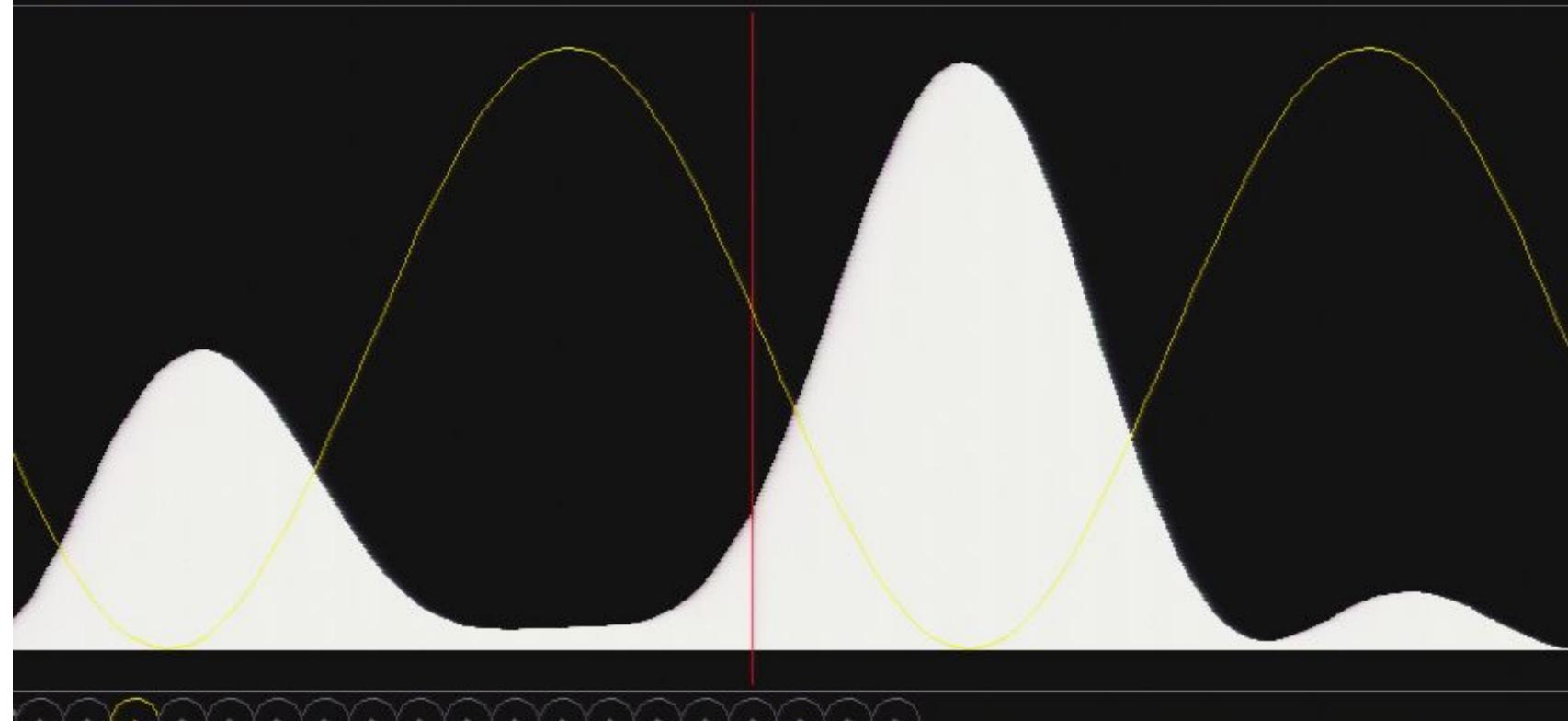
Simulation Speed

Radiation Intensity

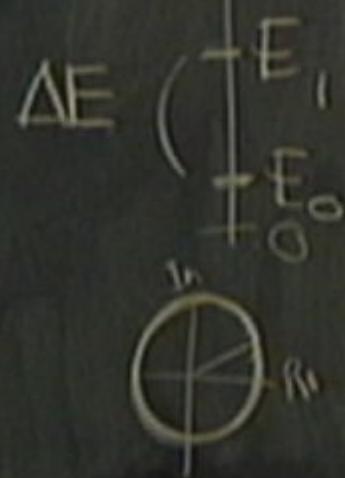
Radiation Frequency

Resolution

Electric Field: Current:



$$f = f_1 - f_0 = \frac{E_1}{\hbar} - \frac{E_0}{\hbar} = \frac{E_1 - E_0}{\hbar} = \frac{\Delta E}{\hbar}$$



$$\Psi_0 = e^{-\frac{i}{\hbar}E_0 t} (\text{Diagram})$$



$$f = f_i - f_o = \frac{E_i}{\hbar} - \frac{E_o}{\hbar} = \frac{E_i - E_o}{\hbar} = \frac{\Delta E}{\hbar}$$

Diagram illustrating the energy levels and transition:

- A vertical axis labeled ΔE shows energy levels E_i and E_o .
- An upward arrow indicates the transition from E_o to E_i .
- A downward arrow indicates the transition from E_i to E_o .
- A horizontal arrow labeled $-\frac{\Delta E}{\hbar}t$ points to the right, indicating the time evolution of the system.
- Two waveforms are shown: a dashed sine wave and a solid sine wave, representing the state of the system over time.

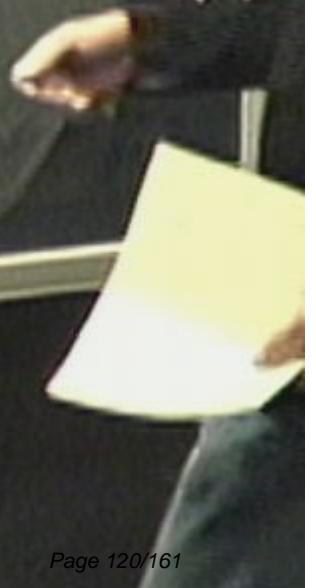
$$f = f_i - f_o = \frac{E_i}{h} - \frac{E_o}{h} = \frac{E_i - E_o}{h} = \frac{\Delta E}{h}$$
$$N = e^{-\frac{E_o}{kT}} \left(\frac{1}{e^{\frac{\Delta E}{kT}}} + 1 \right)$$

$$f = f_i - f_o = \frac{E_i}{\hbar} - \frac{E_o}{\hbar} = \frac{E_i - E_o}{\hbar} = \frac{4E}{\hbar}$$

$$T = e^{-\frac{i}{\hbar}E_0 t}$$

$$\Delta E \left(\begin{array}{c} E_i \\ E_o \end{array} \right)$$

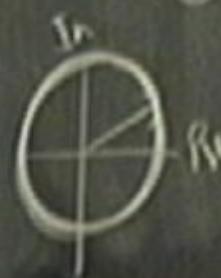
$$= e^{-\frac{i}{\hbar}E_0 t} \left\{ \begin{array}{c} \text{triangle} \\ + e^{-\frac{i}{\hbar}(E_i - E_o)t} \end{array} \right.$$



$$f = f_i - f_o = \frac{E_i}{\hbar} - \frac{E_o}{\hbar} = \frac{E_i - E_o}{\hbar} = \frac{4E}{\hbar}$$

$$N = e^{-\frac{i}{\hbar}E_0 t} \left(\text{Diagram A} \right) + e^{\frac{i}{\hbar}(E_i - E_o)t} \left(\text{Diagram B} \right)$$

$$\Delta E \left(\begin{array}{c} E_i \\ E_o \end{array} \right) = e^{-\frac{i}{\hbar}E_0 t} \left\{ \begin{array}{c} \text{Diagram A} \\ + e^{-\frac{i}{\hbar}(E_i - E_o)t} \end{array} \right. \left. \begin{array}{c} \text{Diagram B} \\ + e^{i(E_i - E_o)t} \end{array} \right\}$$



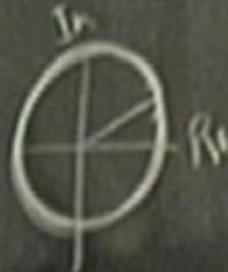
$$f = f_i - f_o = \frac{E_i}{\hbar} - \frac{E_o}{\hbar} = \frac{E_i - E_o}{\hbar} = \frac{\Delta E}{\hbar} = \frac{4E}{\hbar}$$

$+E_2$

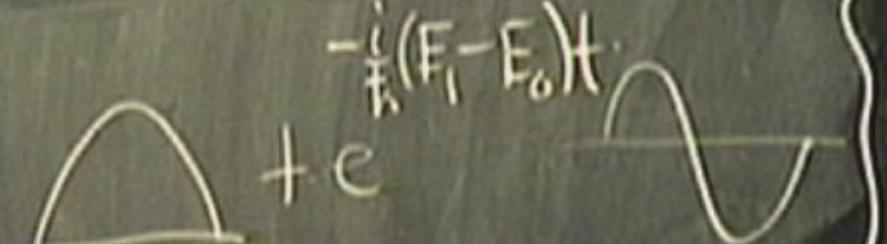
$$N = e^{-\frac{i}{\hbar}E_o t}$$



$$\Delta E \left(+E_i +E_o \right)$$



$$= e^{\cancel{i} E_o t}$$



$$-\frac{i}{\hbar}(E_i - E_o)t$$



$$f = f_i - f_o = \frac{E_i}{\hbar} - \frac{E_o}{\hbar} = \frac{E_i - E_o}{\hbar} = \frac{\Delta E}{\hbar}$$

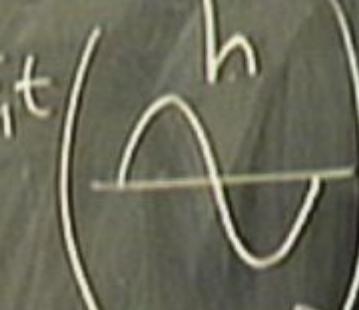
$+ E_2$

$$N = e^{-\frac{i}{\hbar} E_o t}$$

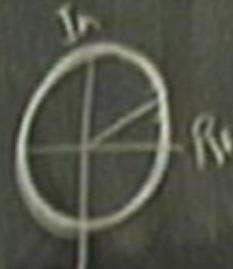


$+ e.$

$$= e^{\frac{i}{\hbar} E_i t}$$



$$\Delta E \left(+ E_i - E_o \right)$$



$$= e^{\frac{i}{\hbar} \Delta E t}$$

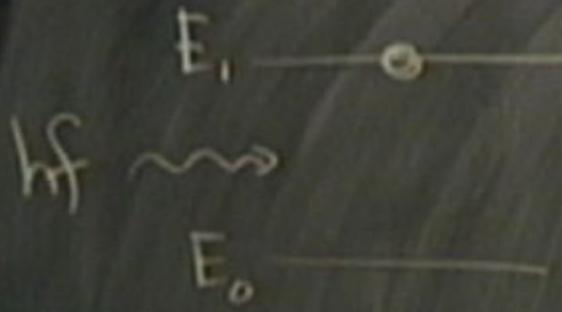
$$= e^{\frac{i}{\hbar} (E_i - E_o) t}$$



$+ e$

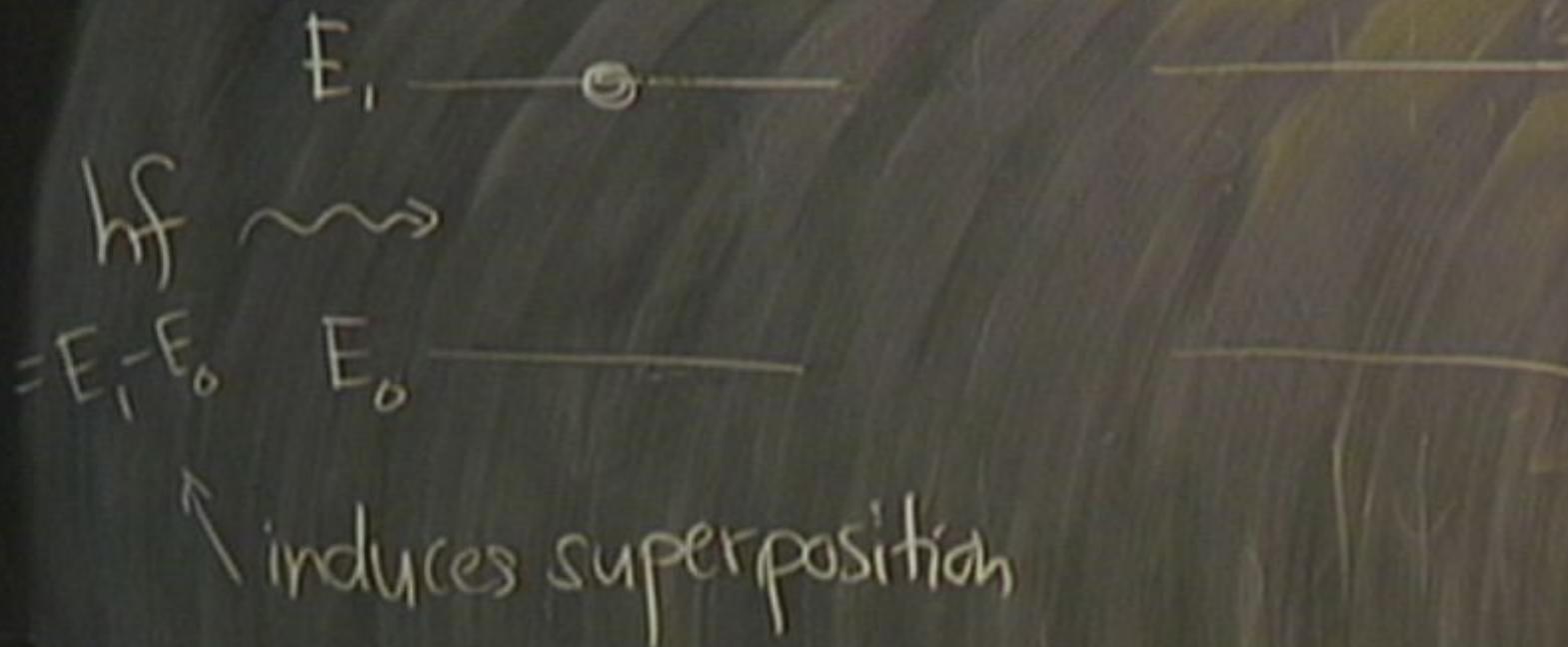


$+ e$



A man with curly hair and a beard, wearing a dark t-shirt, stands at a chalkboard. He is holding a white rectangular piece of paper in his hands, looking down at it. The chalkboard behind him has some handwritten mathematical notation and diagrams.

$$E_i - E_o \xrightarrow{hf} E_o$$



1-d Quantum Transitions Applet v1.5

View

Setup: Infinite Well

Clear

Rescale Graphs

Stop Radiation

Reverse Phase

Stopped

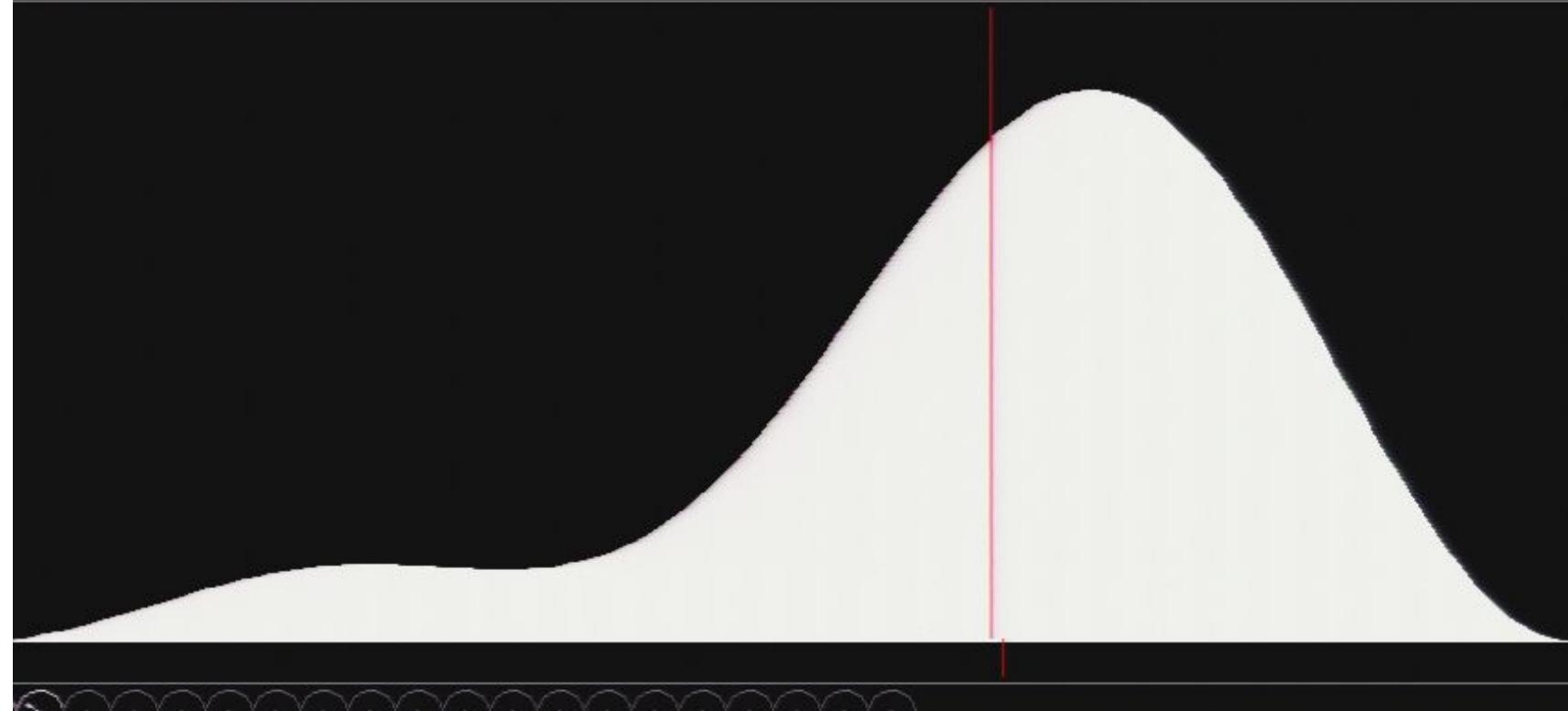
Simulation Speed

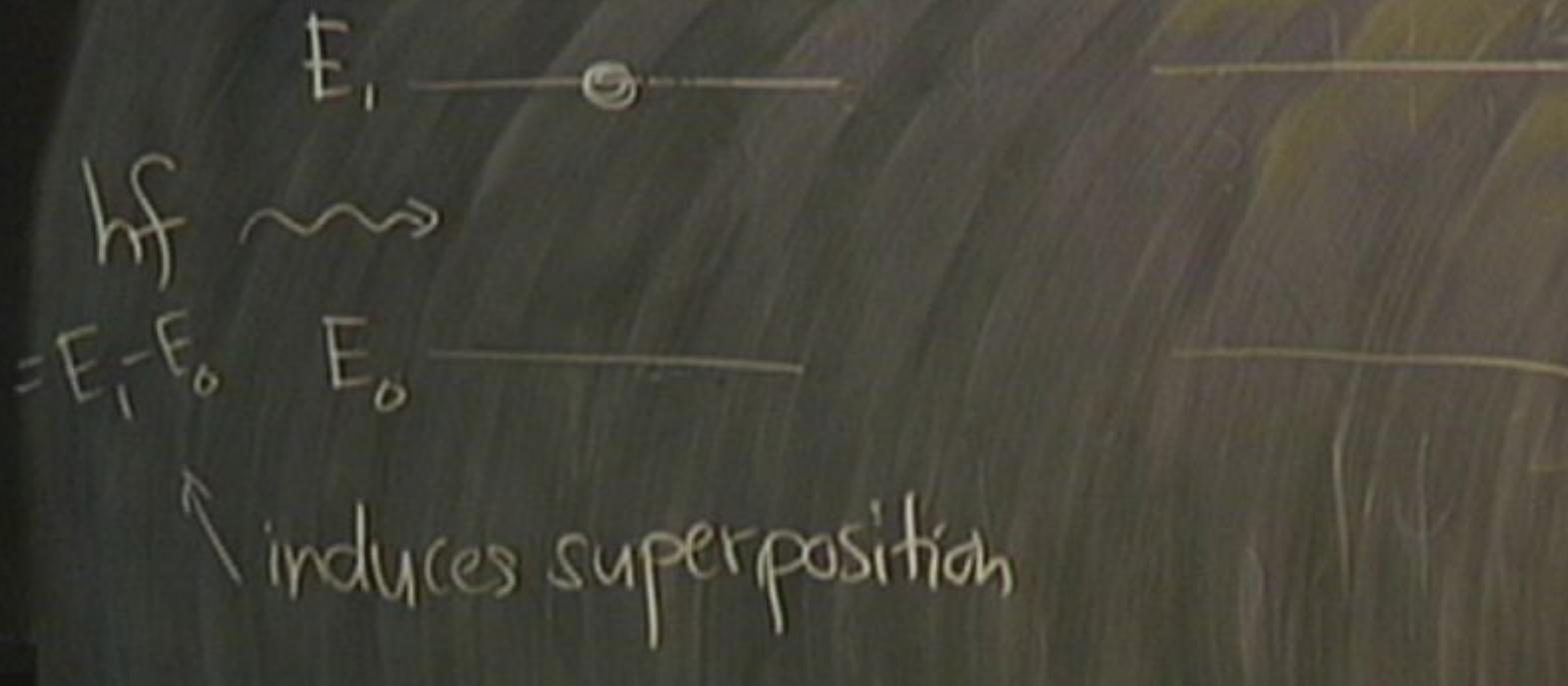
Radiation Intensity

Radiation Frequency

Resolution

Electric Field: Current: →





semiclassical

1-d Quantum Transitions Applet v1.5

View

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Clear

Rescale Graphs

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Reverse Phase

Stopped

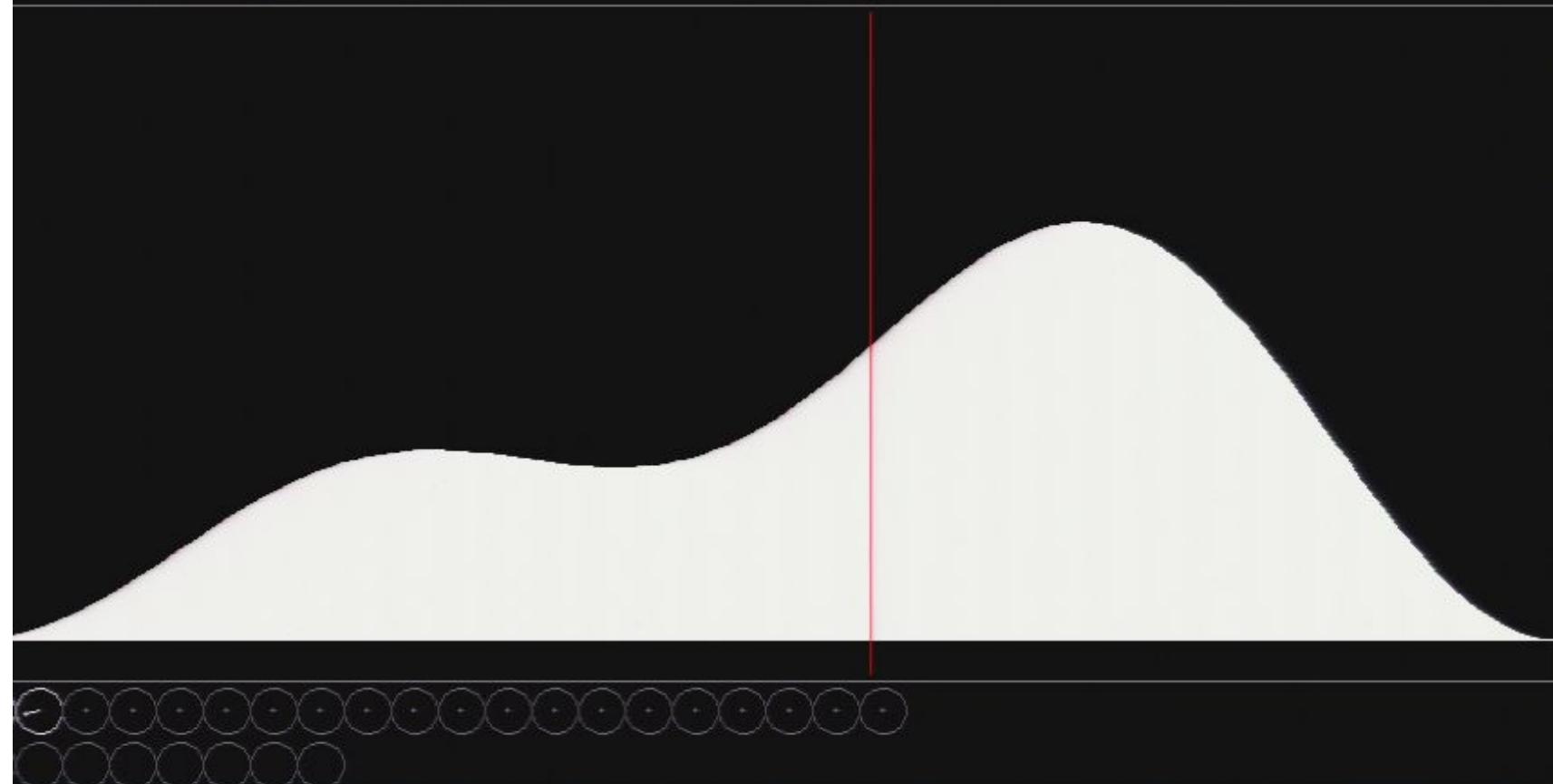
Simulation Speed

Radiation Intensity

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Electric Field: Current: ←



1-d Quantum Transitions Applet v1.5

View

Setup: Infinite Well

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Rescale Graphs

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Reverse Phase

Stopped

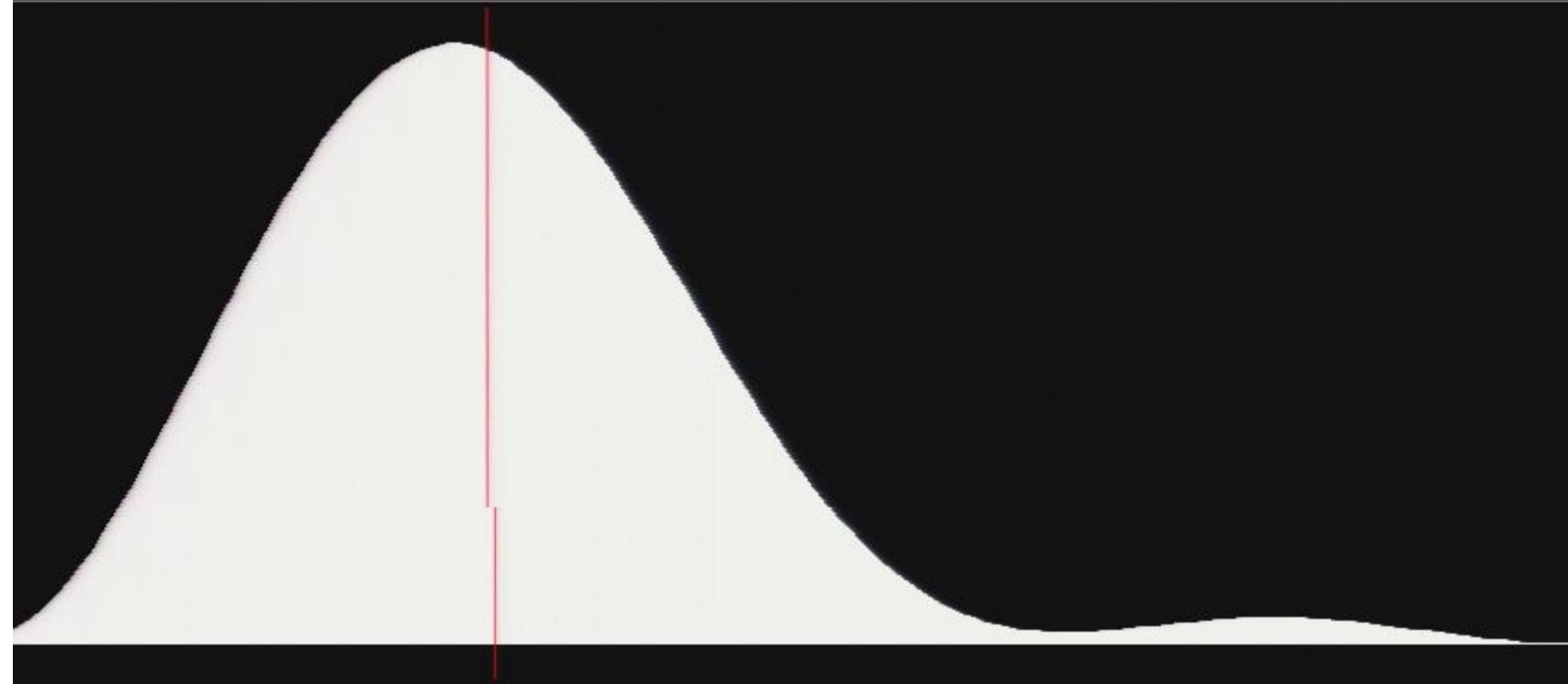
Simulation Speed

Radiation Intensity

Radiation Frequency

Resolution

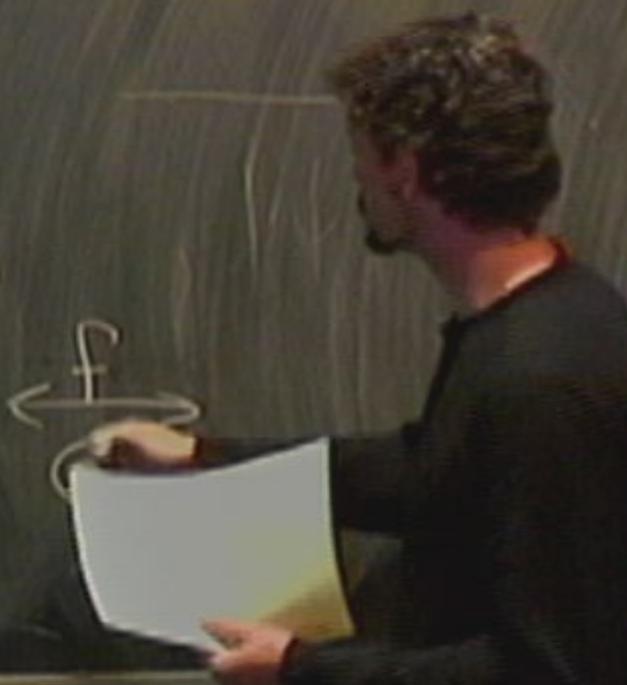
Electric Field: Current:



$$E_i \xrightarrow{\text{hf}} E_o$$
$$\hbar f = E_i - E_o$$

induces superposition

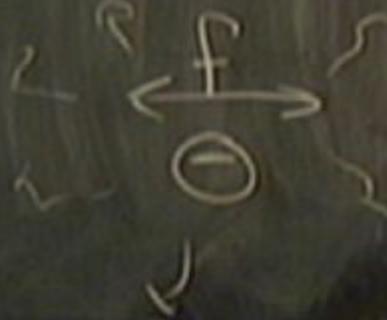
Semiclassical



$$E_1 - E_0 = \hbar f$$

induces superposition

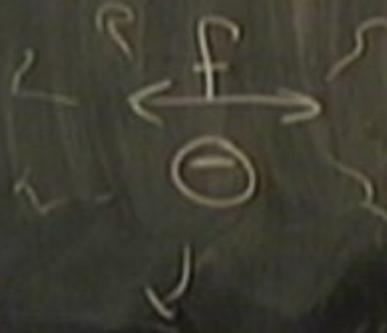
Semiclassical

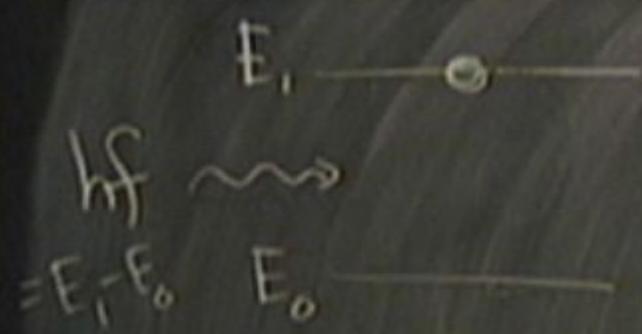




induces superposition

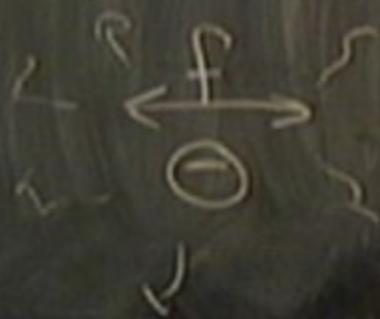
Semiclassical



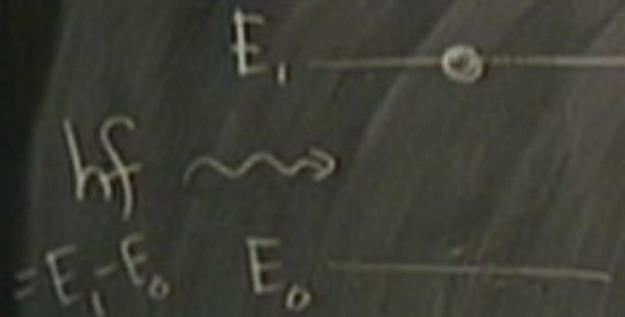


induces superposition

Semiclassical

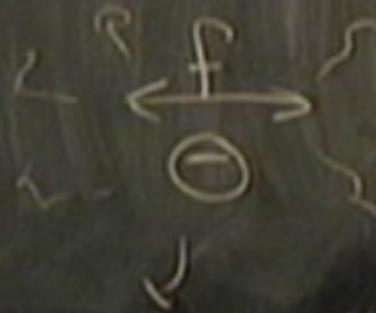


LASER

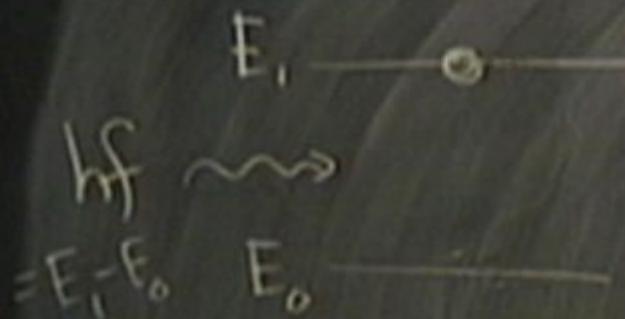


induces superposition

Semiclassical



LASER

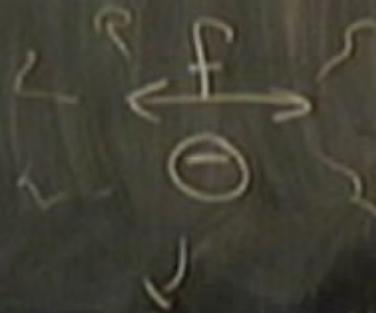


$$= E_i - E_o$$



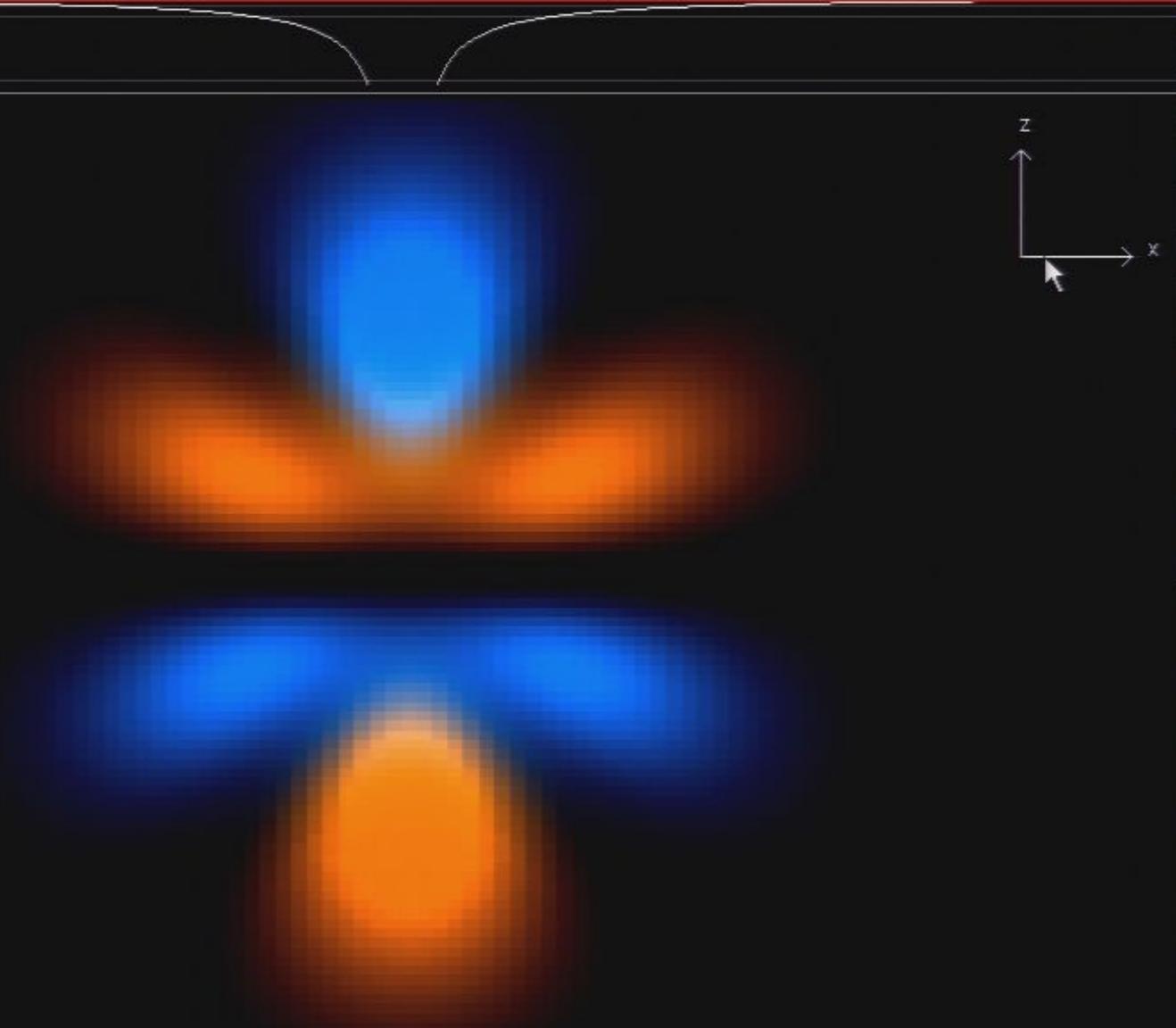
induces superposition

Semiclassical



Hydrogenic Atom Viewer v1.5

View Options Samples



Complex Combos (n=1-4)

No Slicing

Mouse = Adjust View

Stopped

Clear

Normalize

Maximize

Simulation Speed

Brightness

Image Resolution

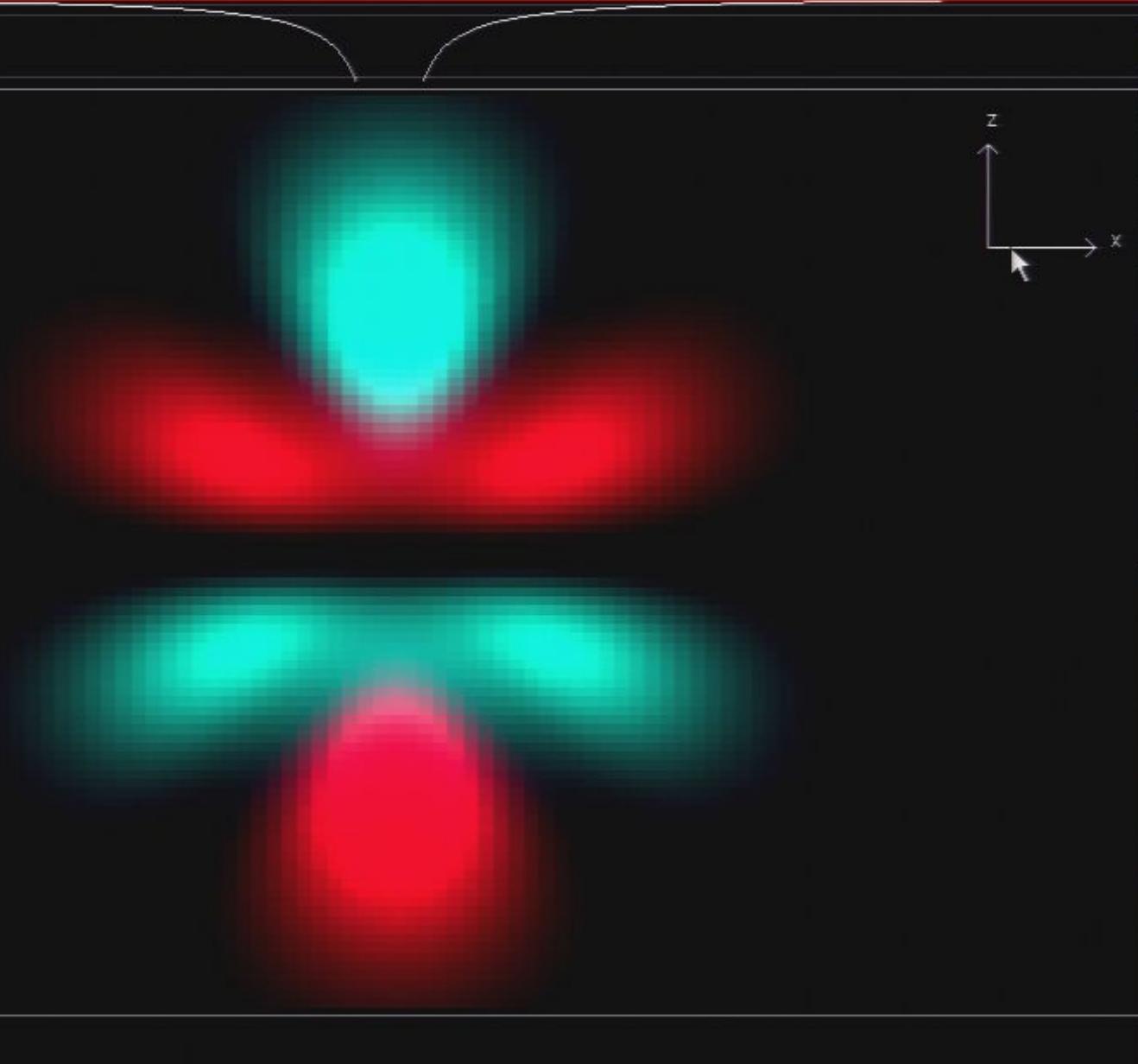
Scale

<http://www.falstad.com>



Hydrogenic Atom Viewer v1.5

View Options Samples



Complex Combos (n=1-4)

No Slicing

Mouse = Adjust View

Stopped

Clear

Normalize

Maximize

Simulation Speed

Brightness

Image Resolution

Scale

<http://www.falstad.com>



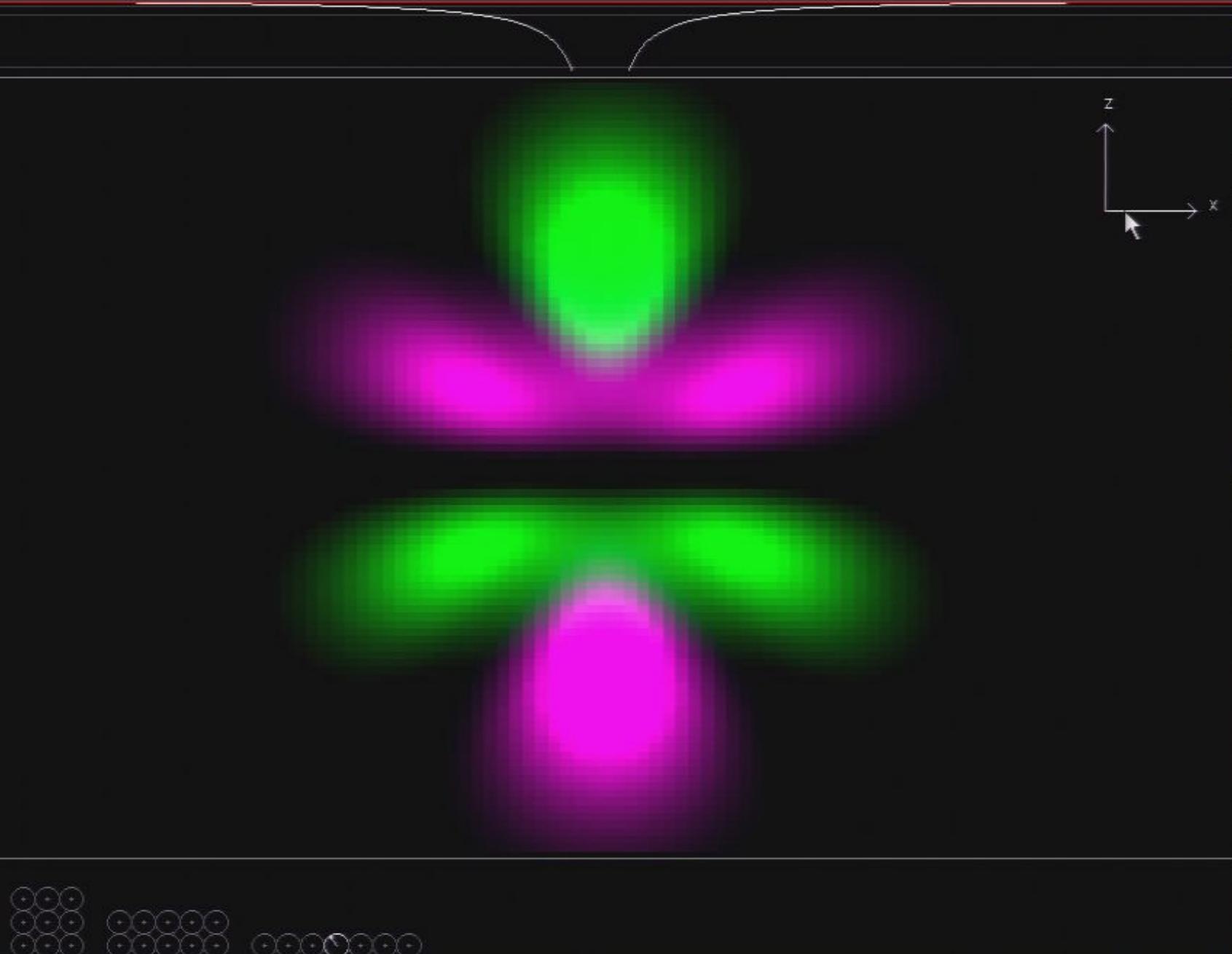
Pirsa: 08070043

Applet Window

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Hydrogenic Atom Viewer v1.5

View Options Samples



Complex Combos (n=1-4)

No Slicing

Mouse = Adjust View

Stopped

Clear

Normalize

Maximize

Simulation Speed

Brightness

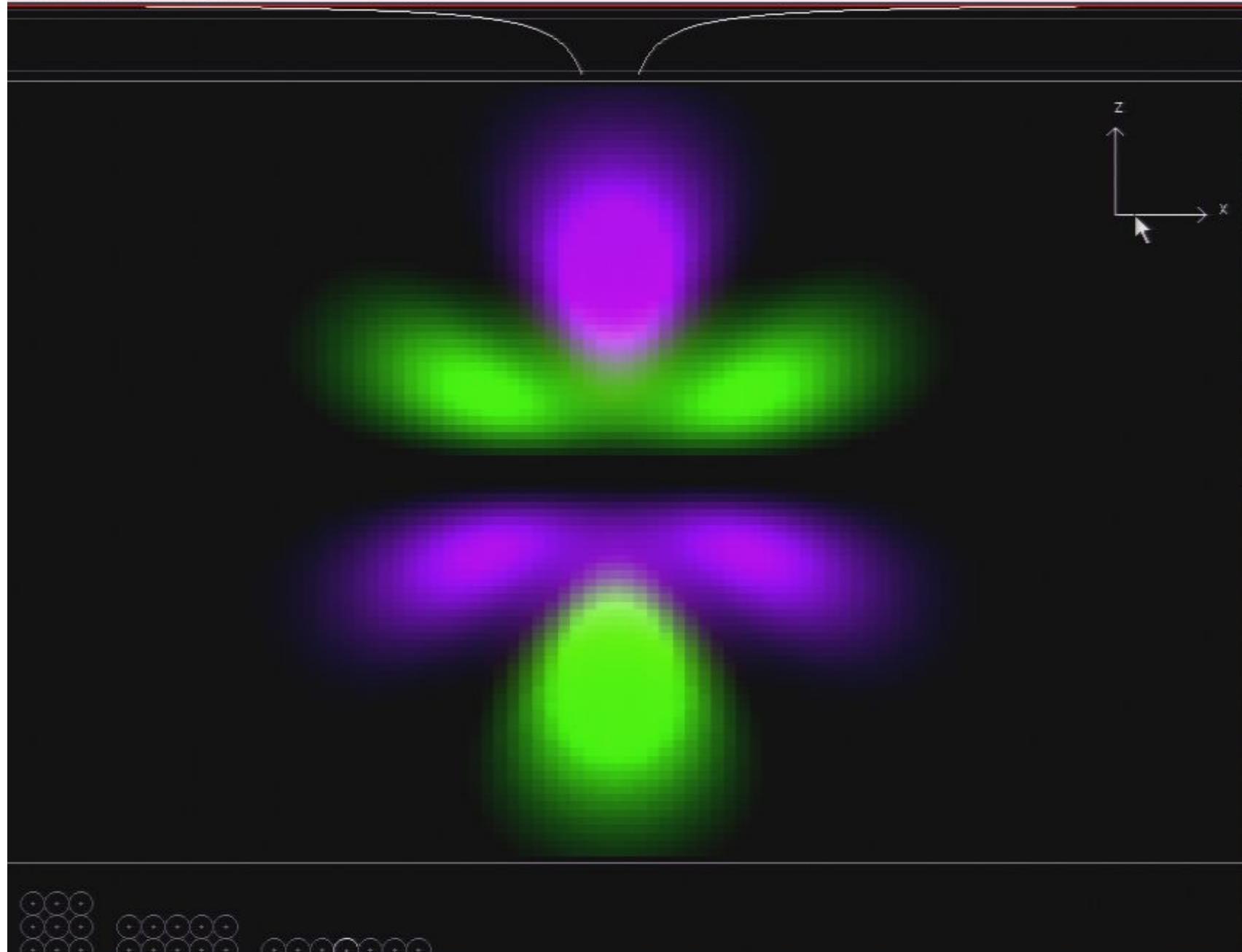
Image Resolution

Scale

<http://www.falstad.com>

Hydrogenic Atom Viewer v1.5

View Options Samples



Complex Combos (n=1-4)

No Slicing

Mouse = Adjust View

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Clear

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Maximize

Simulation Speed

Brightness

Image Resolution

Scale

<http://www.falstad.com>



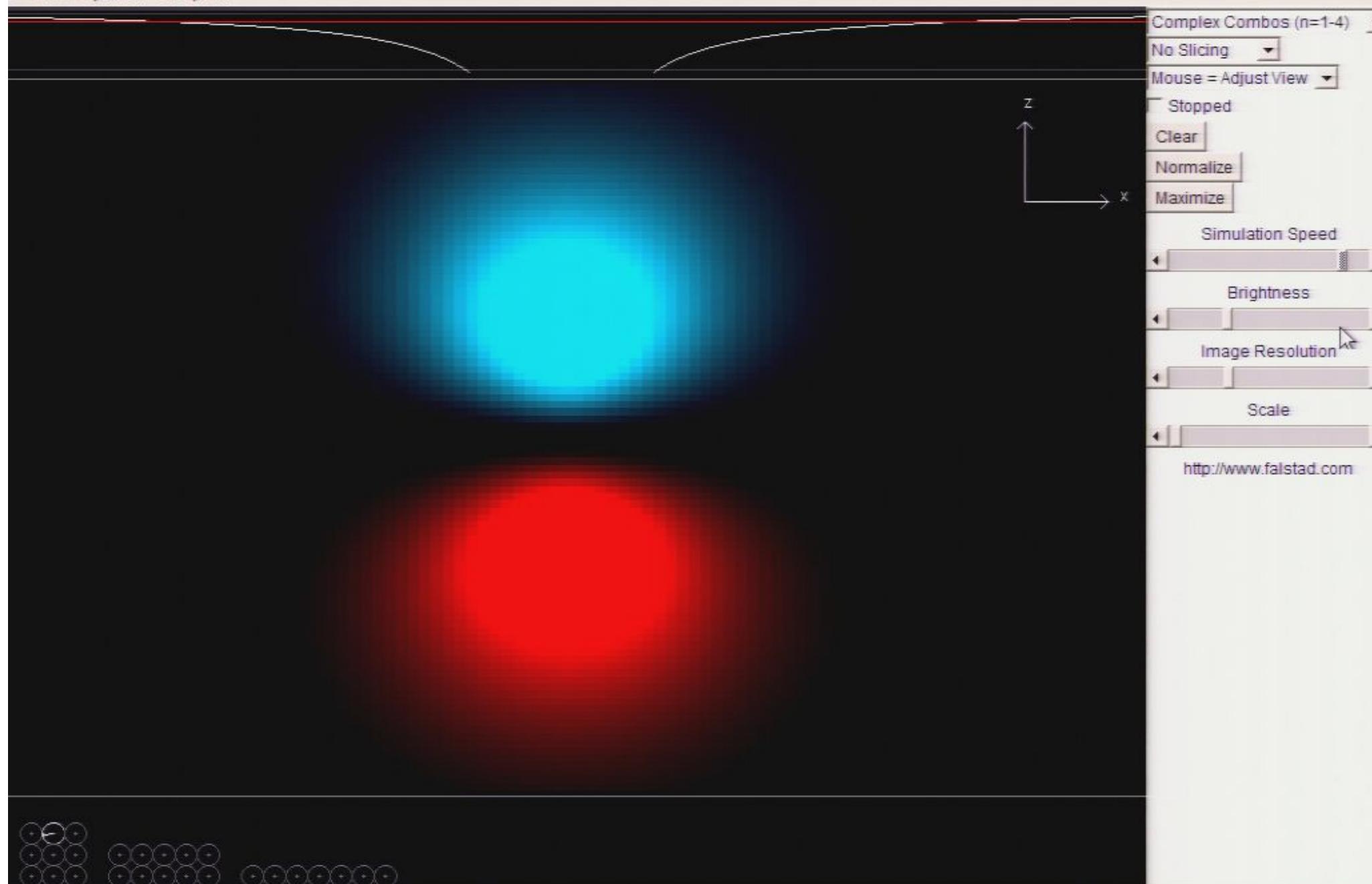
Hydrogenic Atom Viewer v1.5

View Options Samples



Hydrogenic Atom Viewer v1.5

View Options Samples



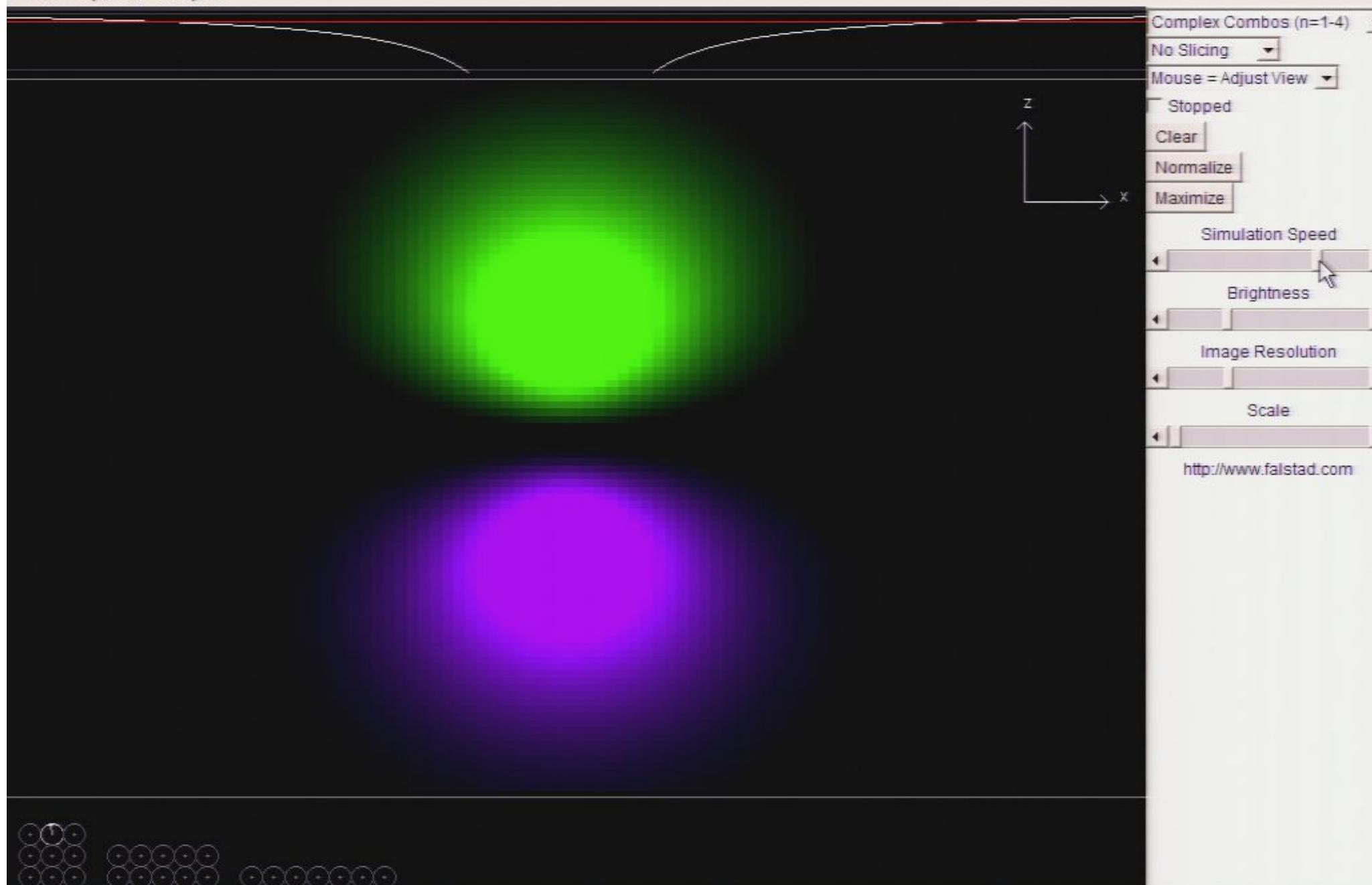
Pirsa: 08070043

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Applet Window

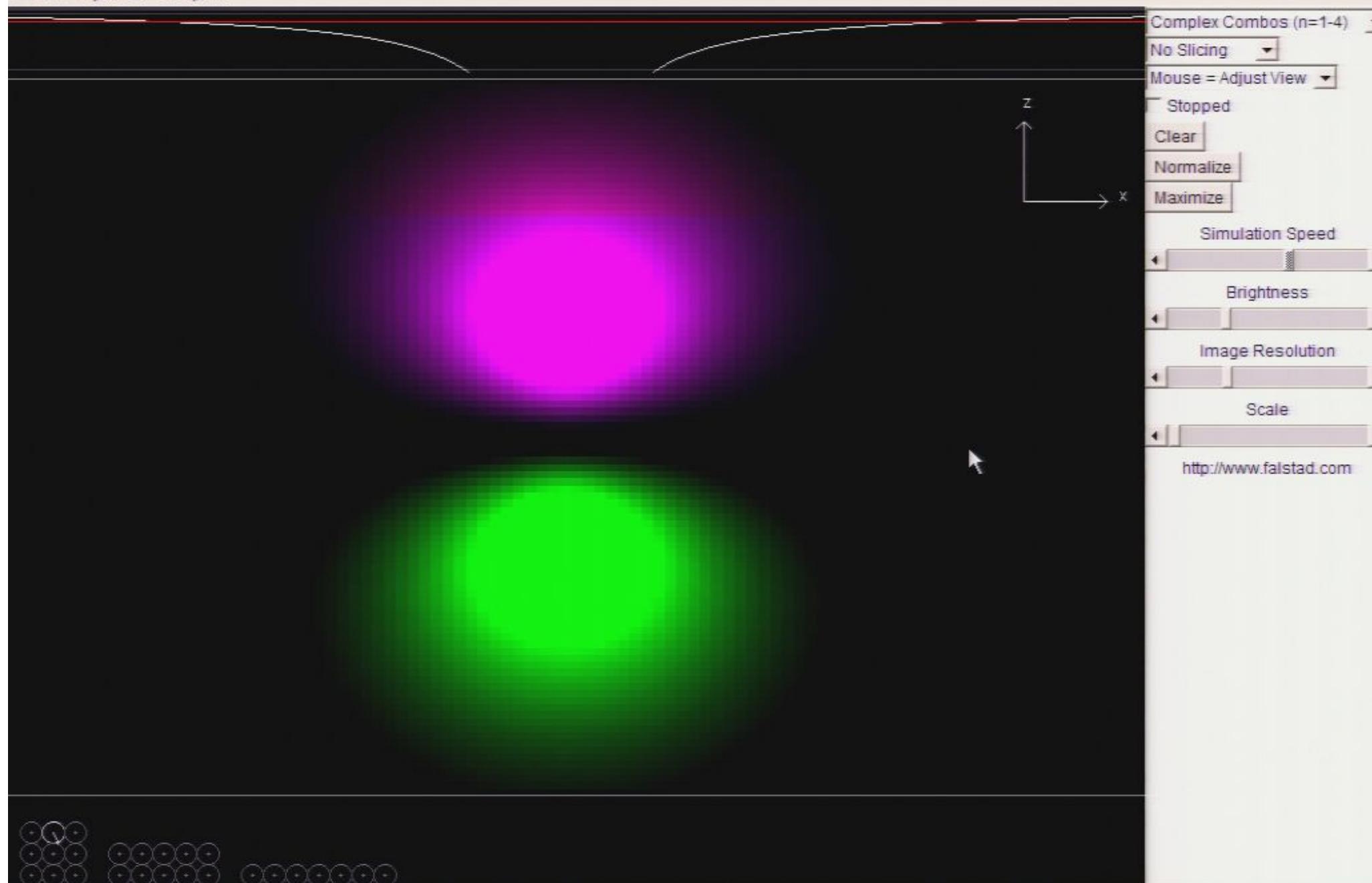
Hydrogenic Atom Viewer v1.5

View Options Samples



Hydrogenic Atom Viewer v1.5

View Options Samples



Pirsa: 08070043

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Applet Window

Hydrogenic Atom Viewer v1.5

View Options Samples



Pirsa: 08070043

Applet Window

Complex Combos (n=1-4)

No Slicing

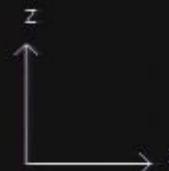
Mouse = Adjust View

Stopped

Clear

Normalize

Maximize



Simulation Speed



Brightness

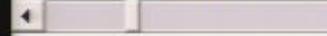
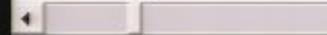


Image Resolution



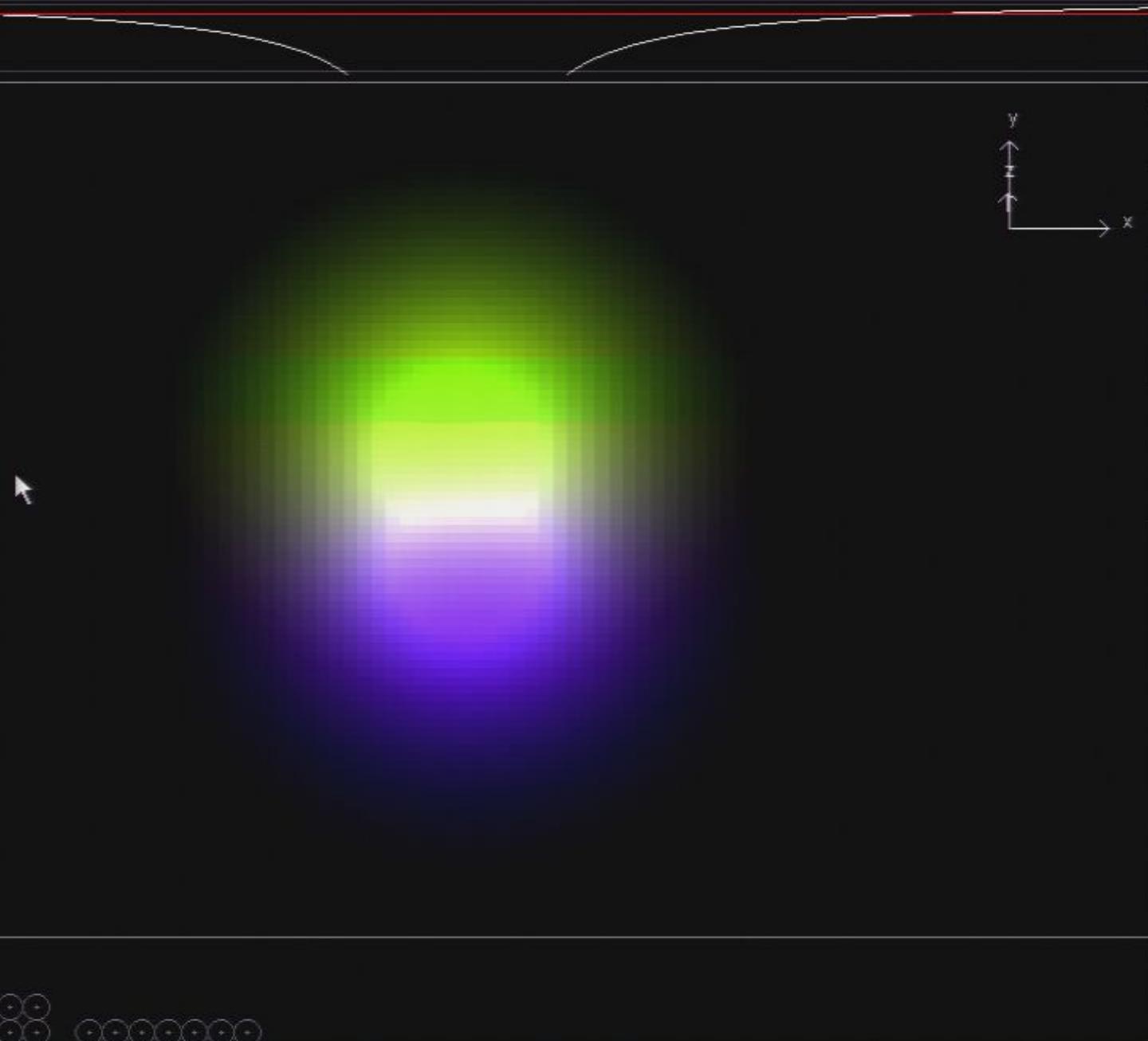
Scale



<http://www.falstad.com>

Hydrogenic Atom Viewer v1.5

View Options Samples



Complex Combos (n=1-4)

No Slicing

Mouse = Adjust View

Stopped

Clear

Normalize

Maximize

Simulation Speed

Brightness

Image Resolution

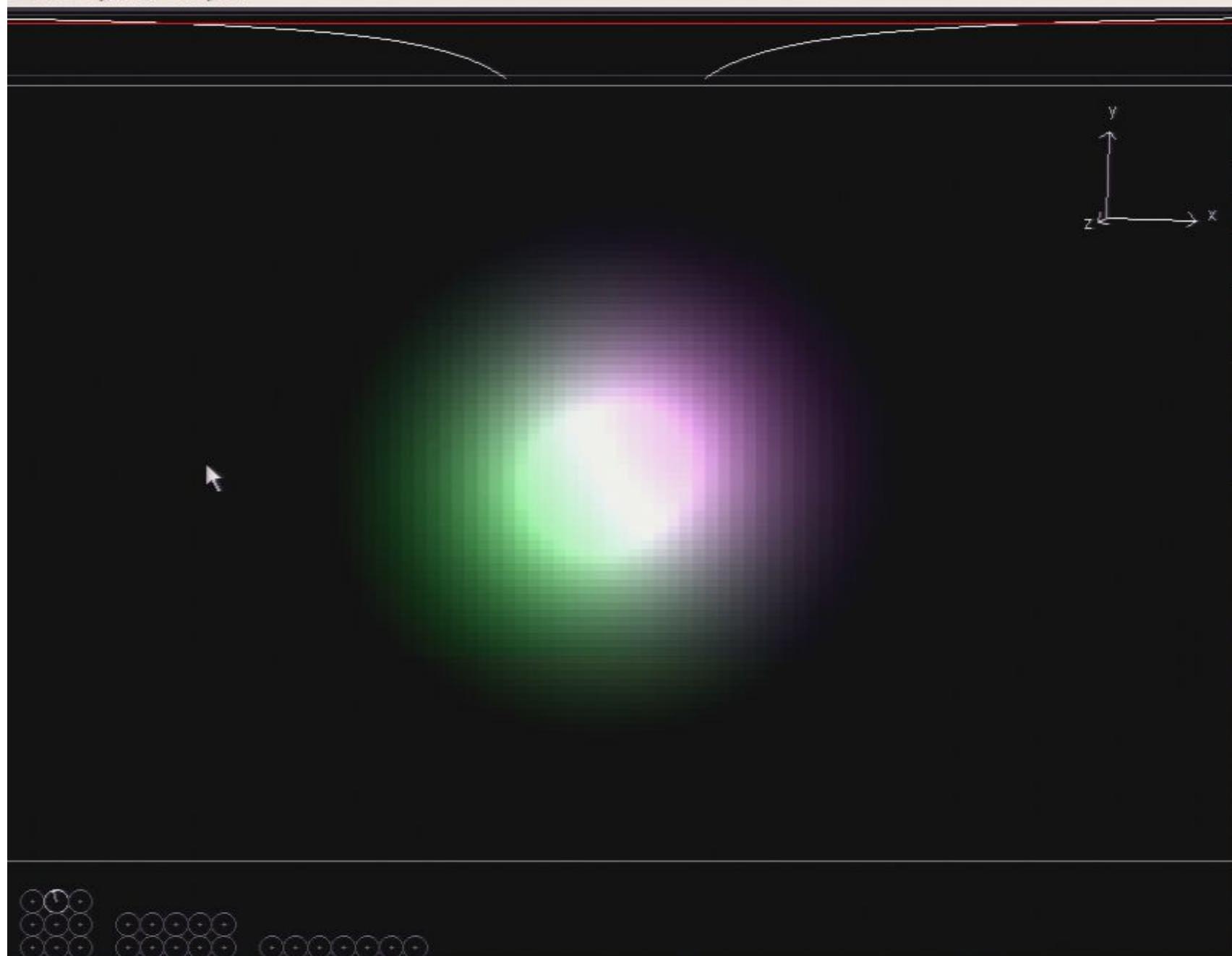
Scale

<http://www.falstad.com>



Hydrogenic Atom Viewer v1.5

View Options Samples



Complex Combos (n=1-4)

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Mouse = Adjust View

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Brightness

Image Resolution

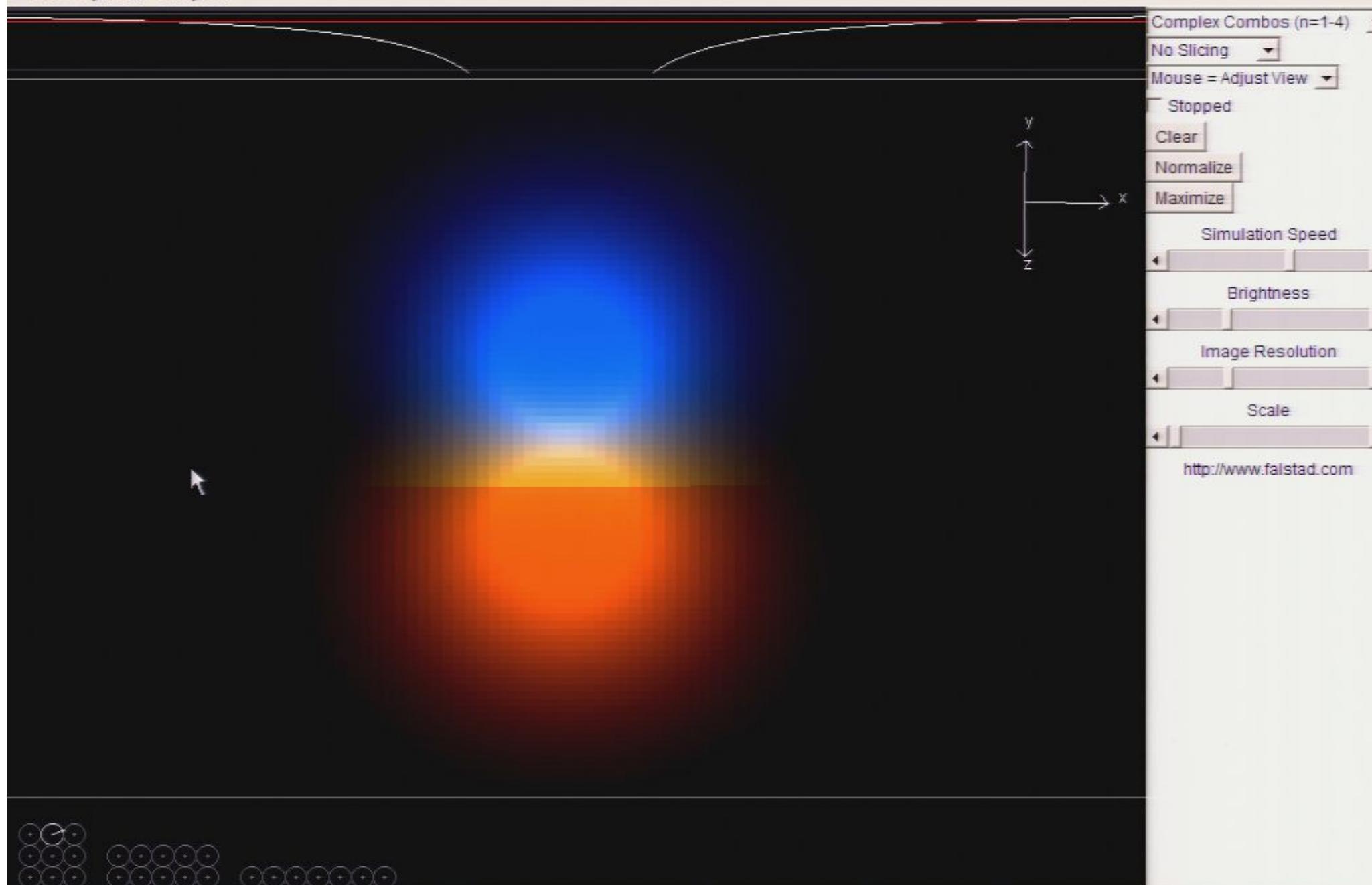
Scale

<http://www.falstad.com>



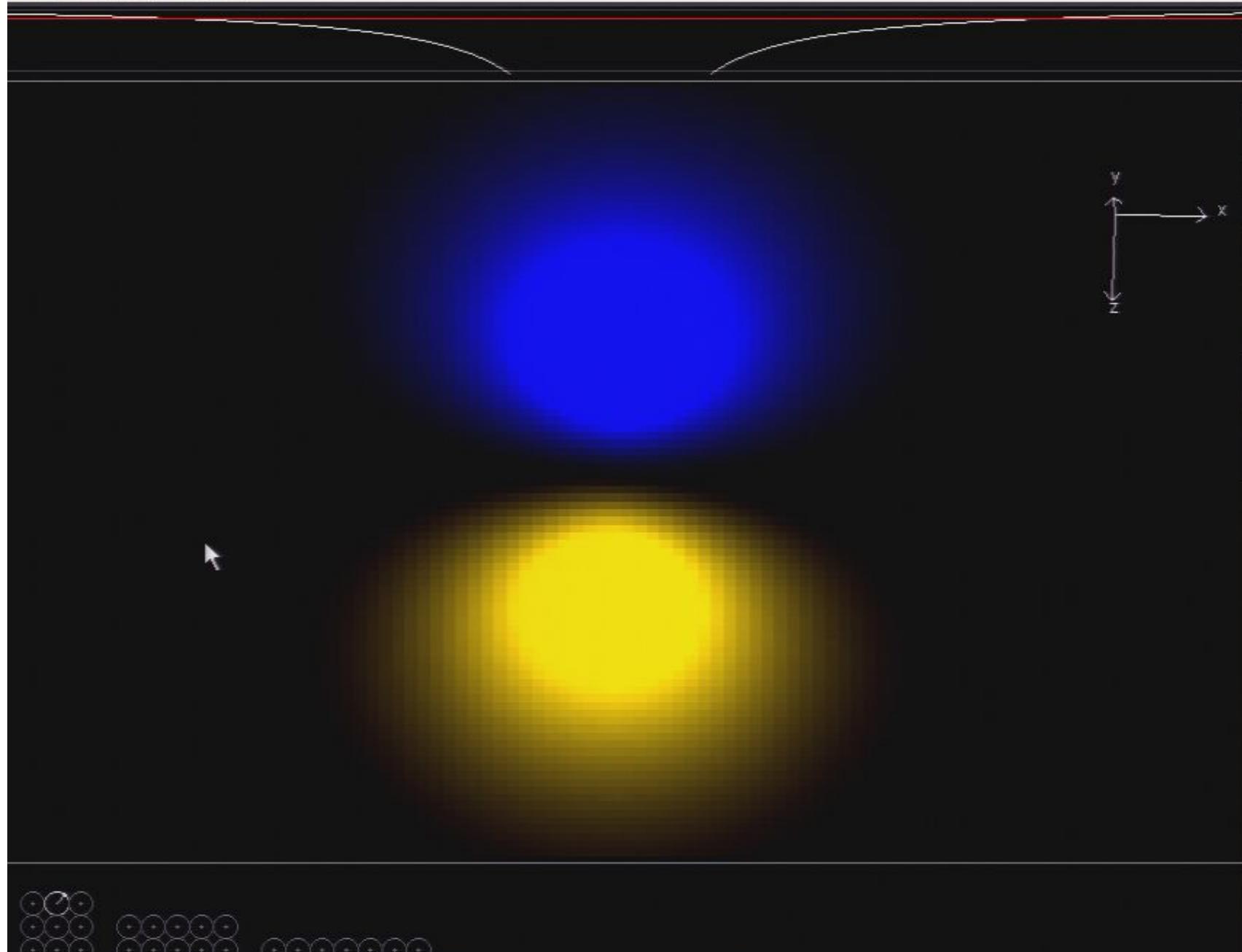
Hydrogenic Atom Viewer v1.5

View Options Samples



Hydrogenic Atom Viewer v1.5

View Options Samples



Complex Combos (n=1-4)

No Slicing

Mouse = Adjust View

Stopped

Clear

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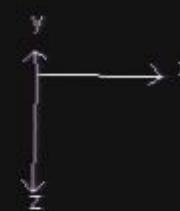
Simulation Speed

Brightness

Image Resolution

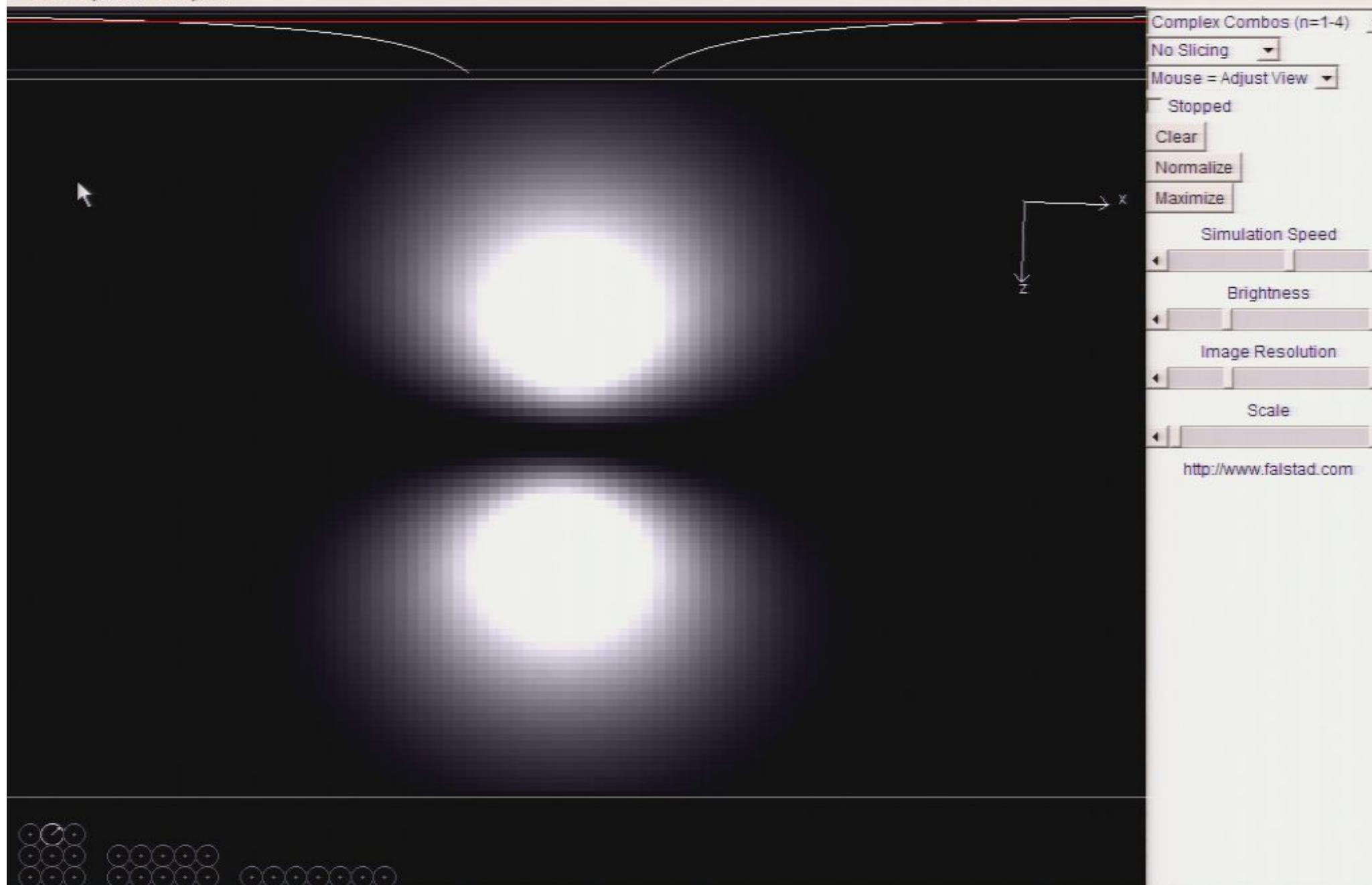
Scale

<http://www.falstad.com>



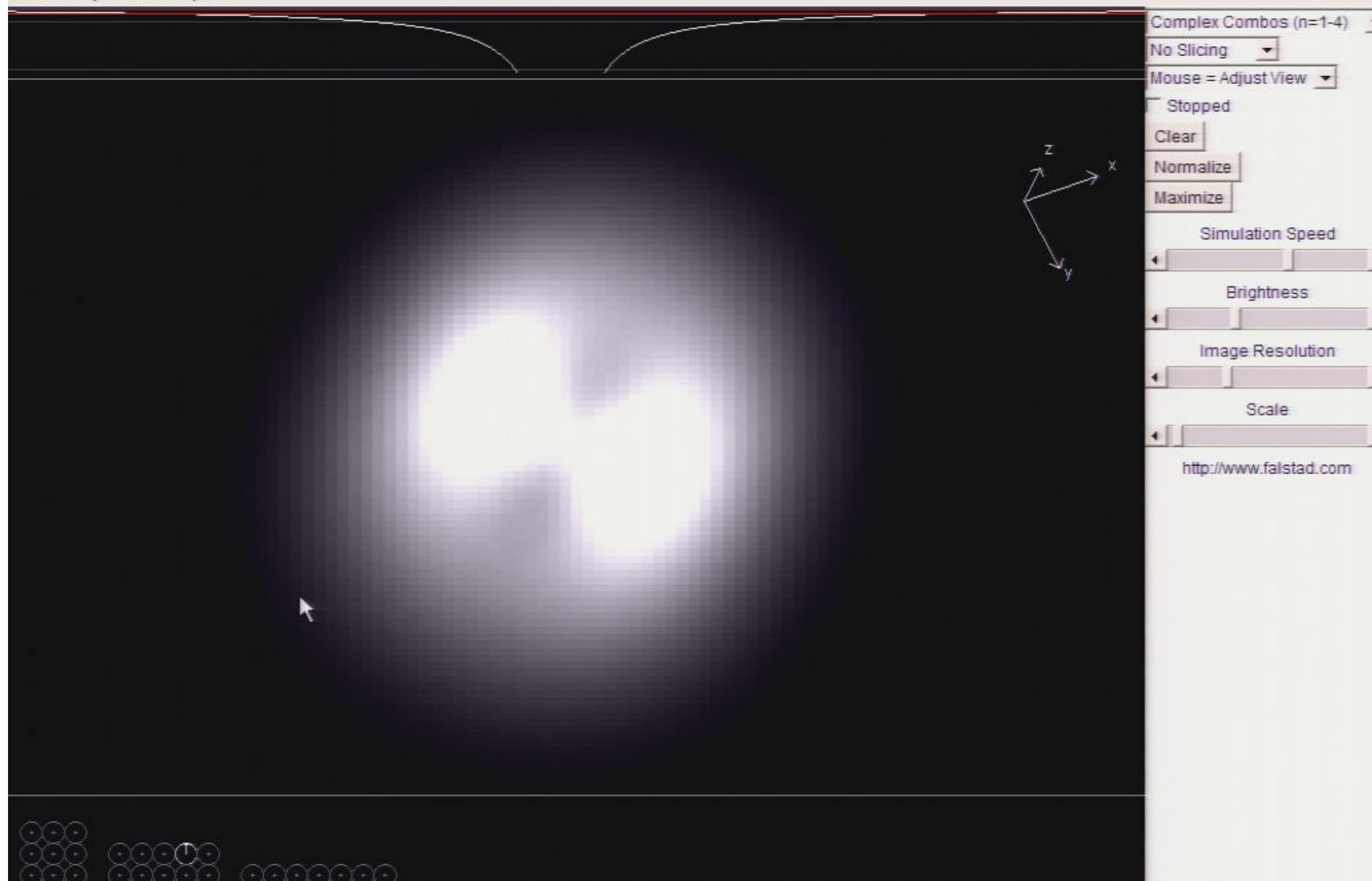
Hydrogenic Atom Viewer v1.5

View Options Samples



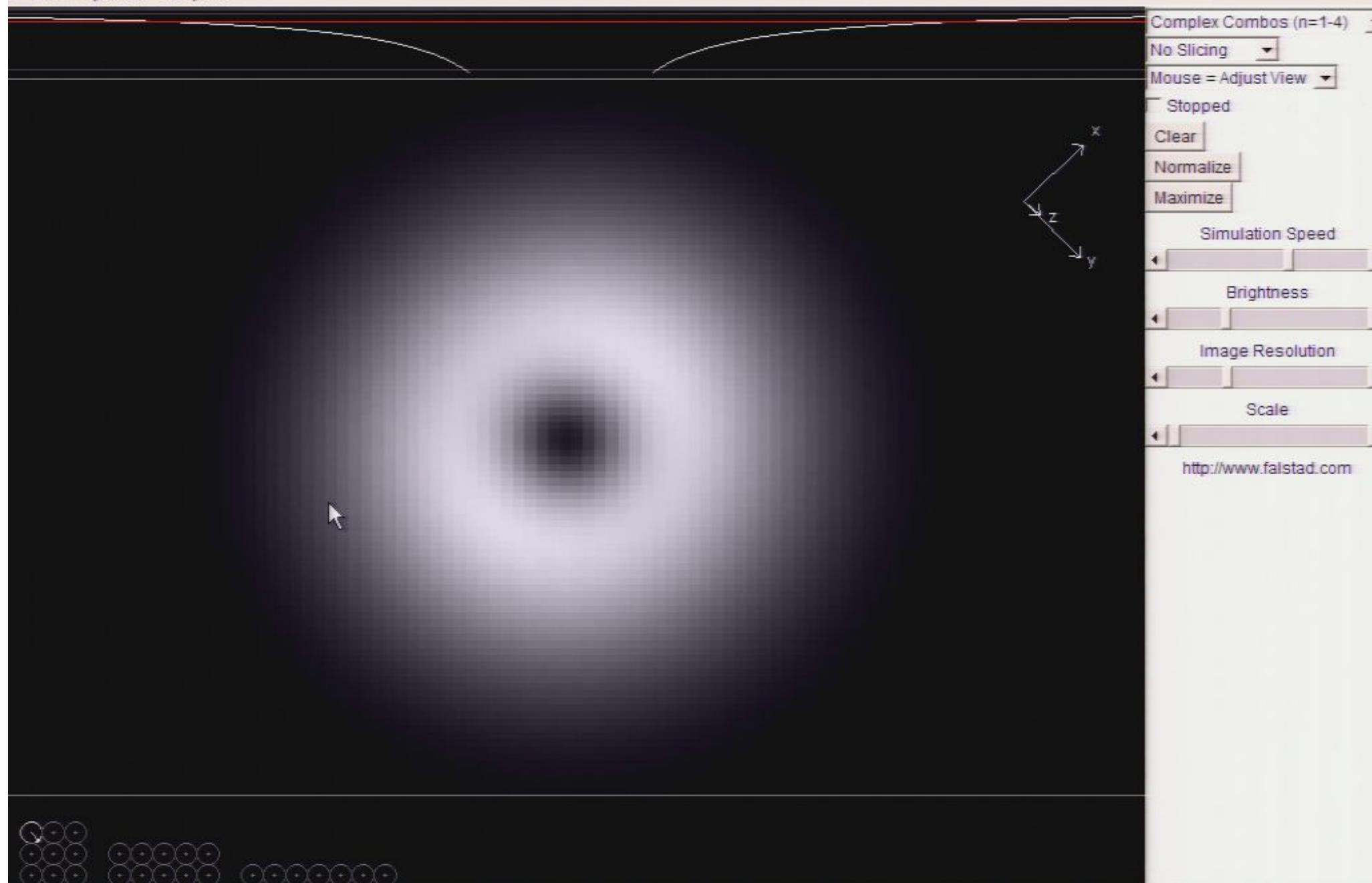
Hydrogenic Atom Viewer v1.5

View Options Samples



Hydrogenic Atom Viewer v1.5

View Options Samples



Hydrogenic Atom Viewer v1.5

View Options Samples



Complex Combos (n=1-4)

No Slicing

Mouse = Adjust View

Stopped

Clear

Normalize

Maximize

Simulation Speed

Brightness

Image Resolution

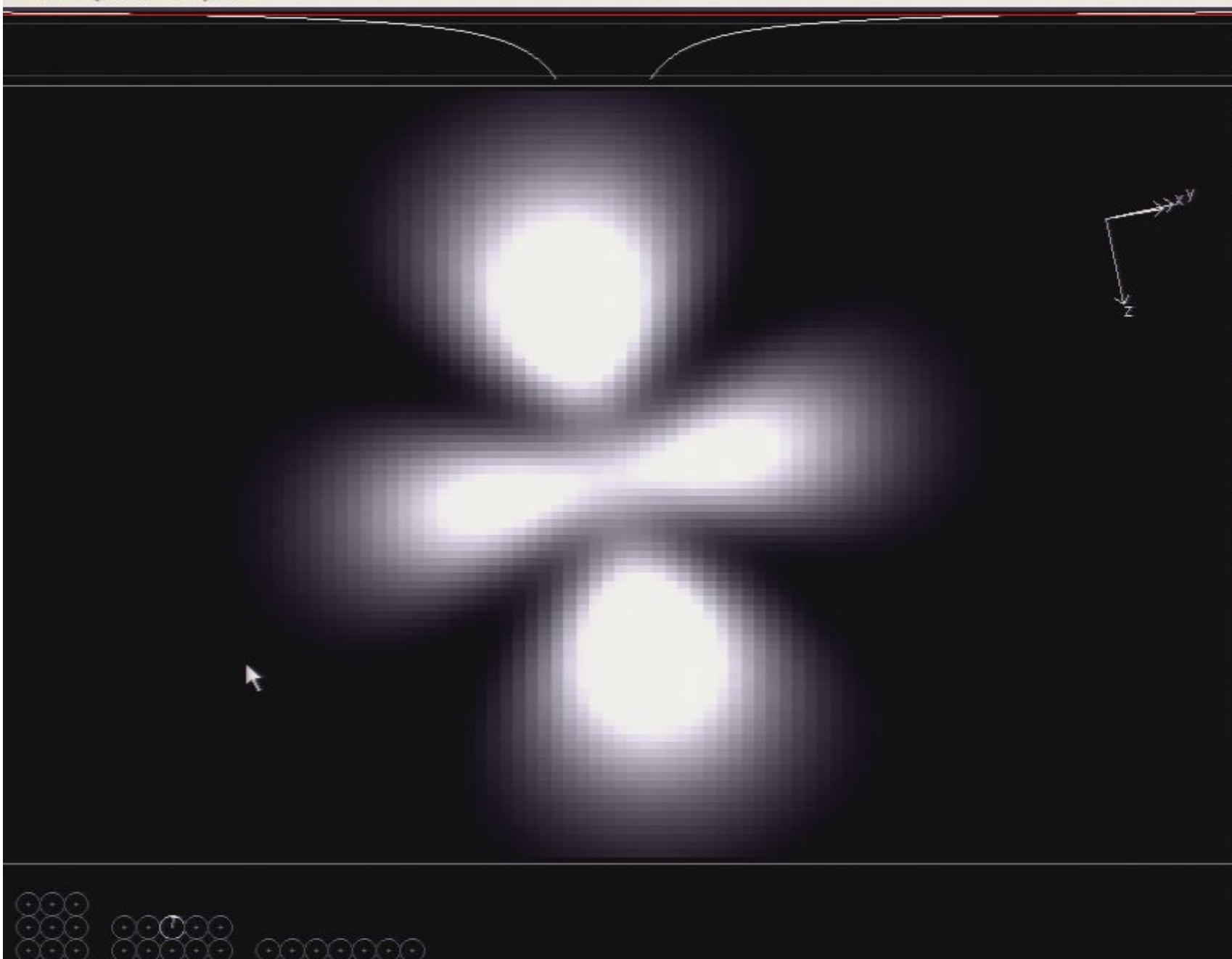
Scale

<http://www.falstad.com>



Hydrogenic Atom Viewer v1.5

View Options Samples



Complex Combos (n=1-4)

No Slicing

Mouse = Adjust View

Stopped

Clear

Normalize

Maximize

Simulation Speed

Brightness

Image Resolution

Scale

<http://www.falstad.com>

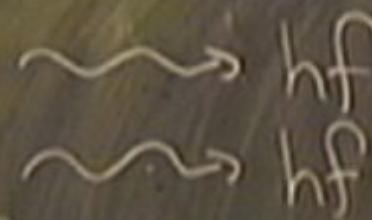
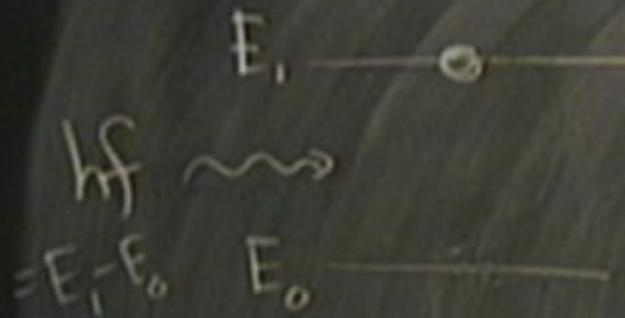


Pirsa: 08070043

Applet Window

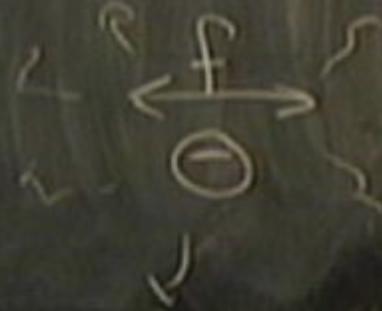
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LASER



induces superposition

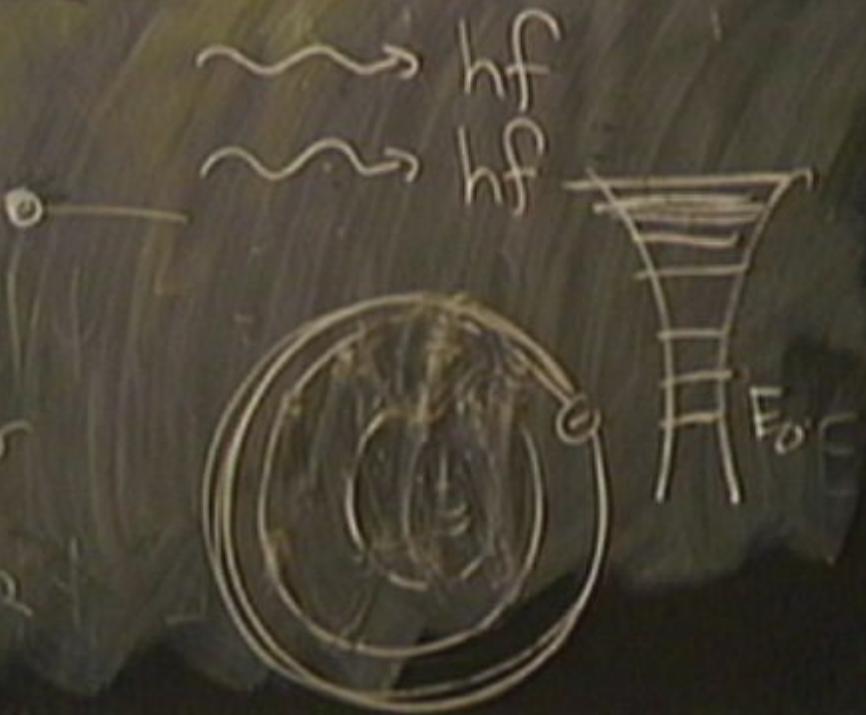
semiclassical



LASER

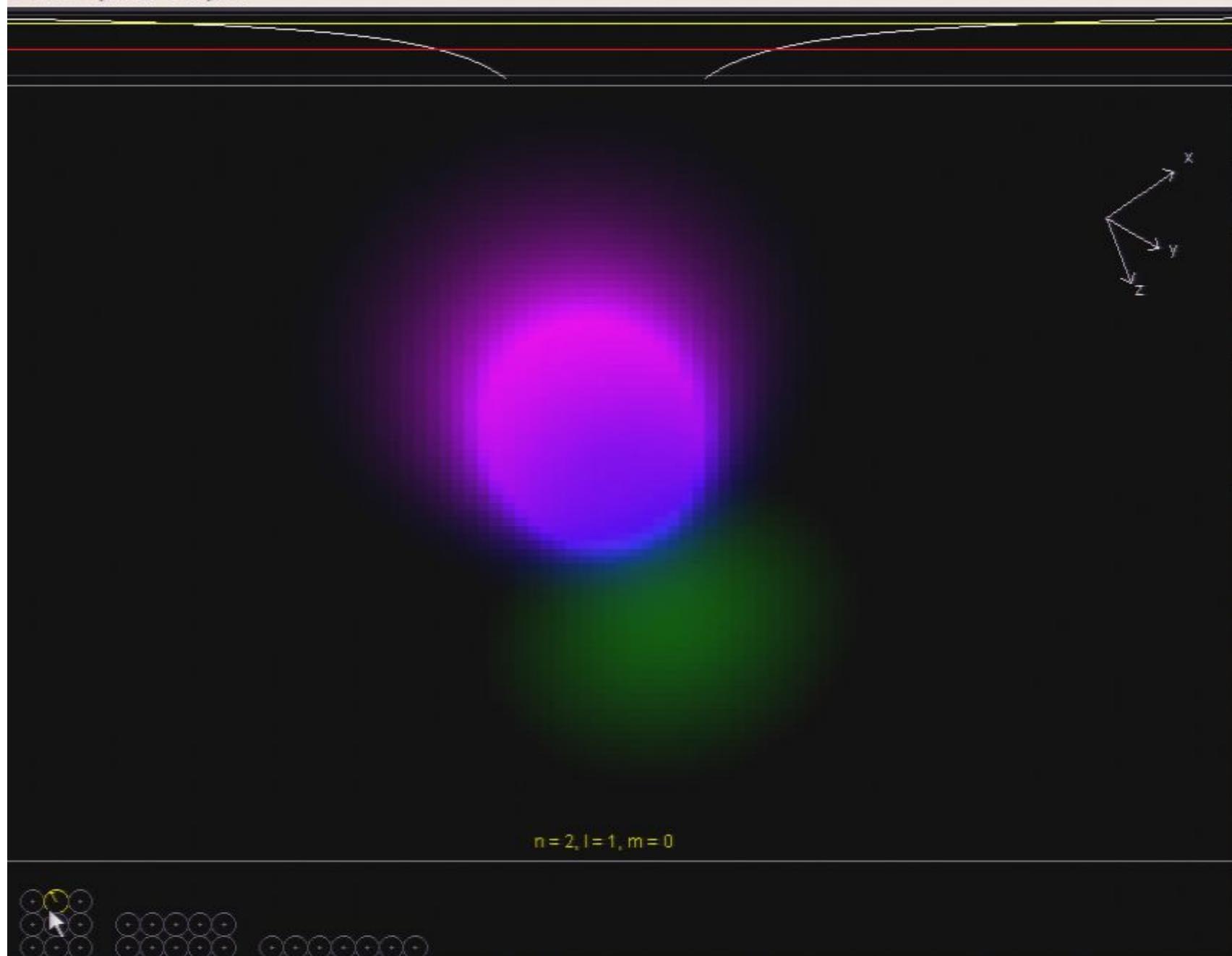
$$E_i - E_o = hf \quad \text{induces superposition}$$

$$E_i - E_o = hf$$



Hydrogenic Atom Viewer v1.5

View Options Samples



Complex Combos (n=1-4)

No Slicing

Mouse = Adjust View

Stopped

Clear

Normalize

Maximize

Simulation Speed

Brightness

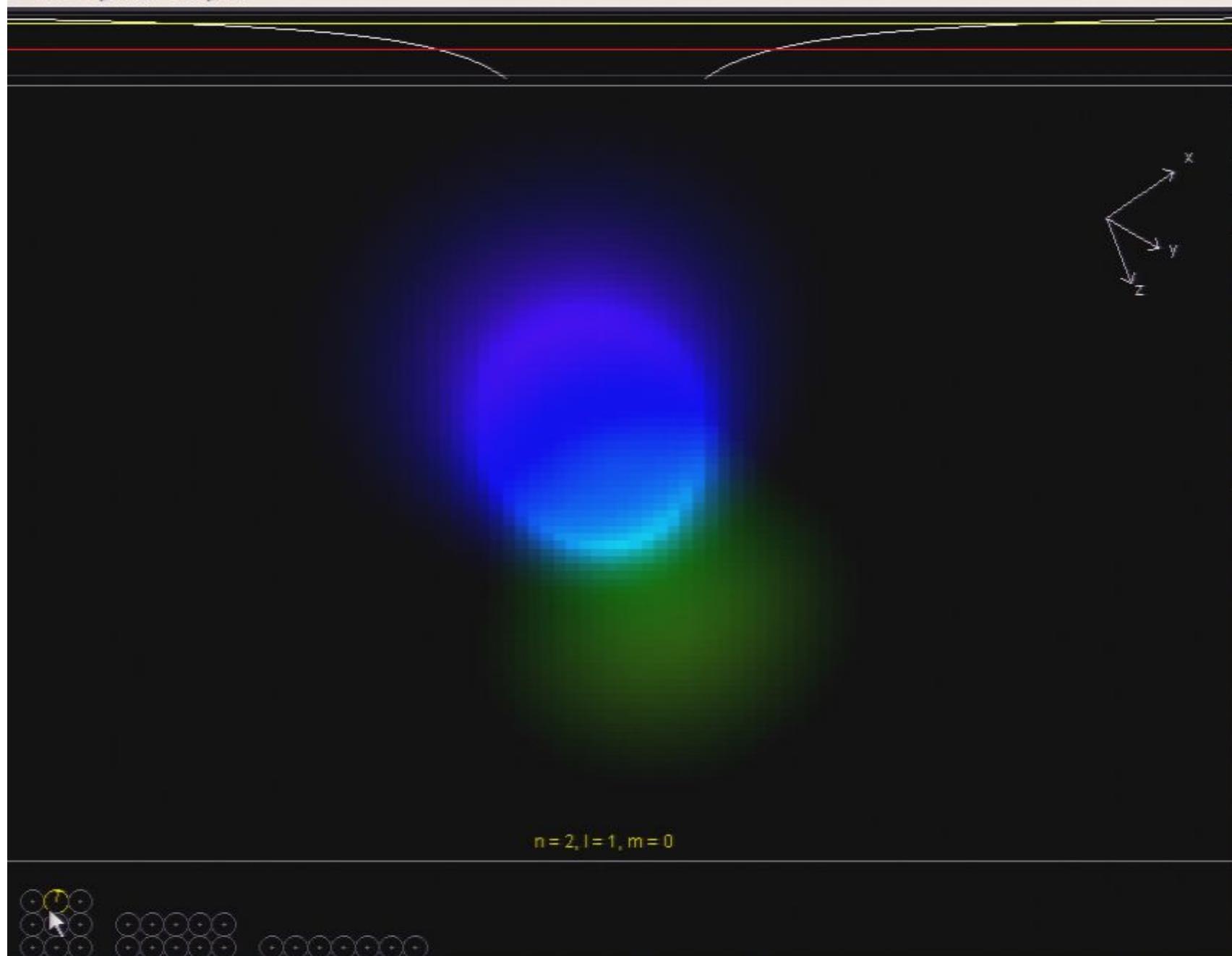
Image Resolution

Scale

<http://www.falstad.com>

Hydrogenic Atom Viewer v1.5

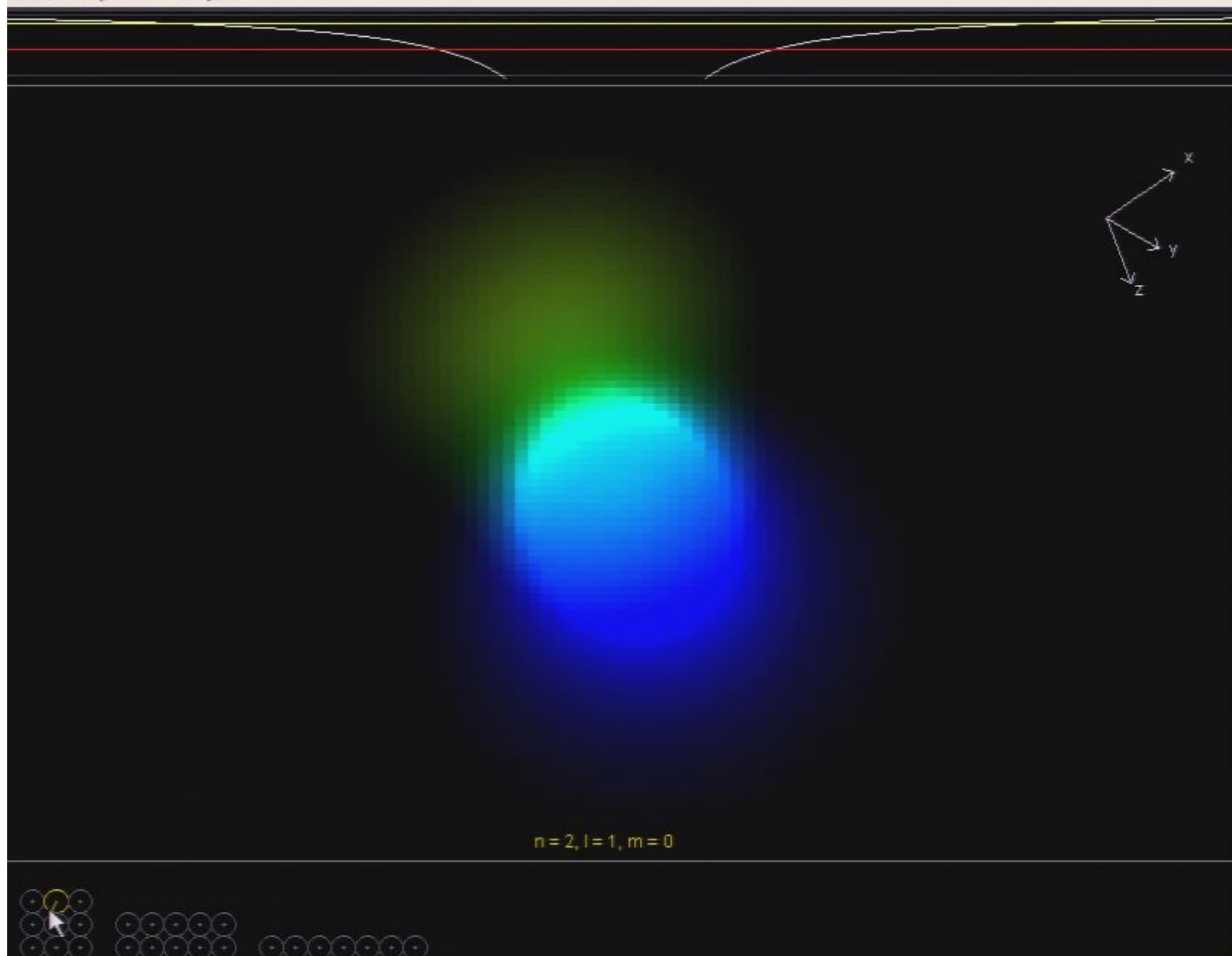
View Options Samples



Complex Combos (n=1-4)
No Slicing
Mouse = Adjust View
Stopped
Clear
Normalize
Maximize
Simulation Speed
Brightness
Image Resolution
Scale
<http://www.falstad.com>

Hydrogenic Atom Viewer v1.5

View Options Samples



Complex Combos (n=1-4)

No Slicing

Mouse = Adjust View

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Normalize

Maximize

Simulation Speed

Brightness

Image Resolution

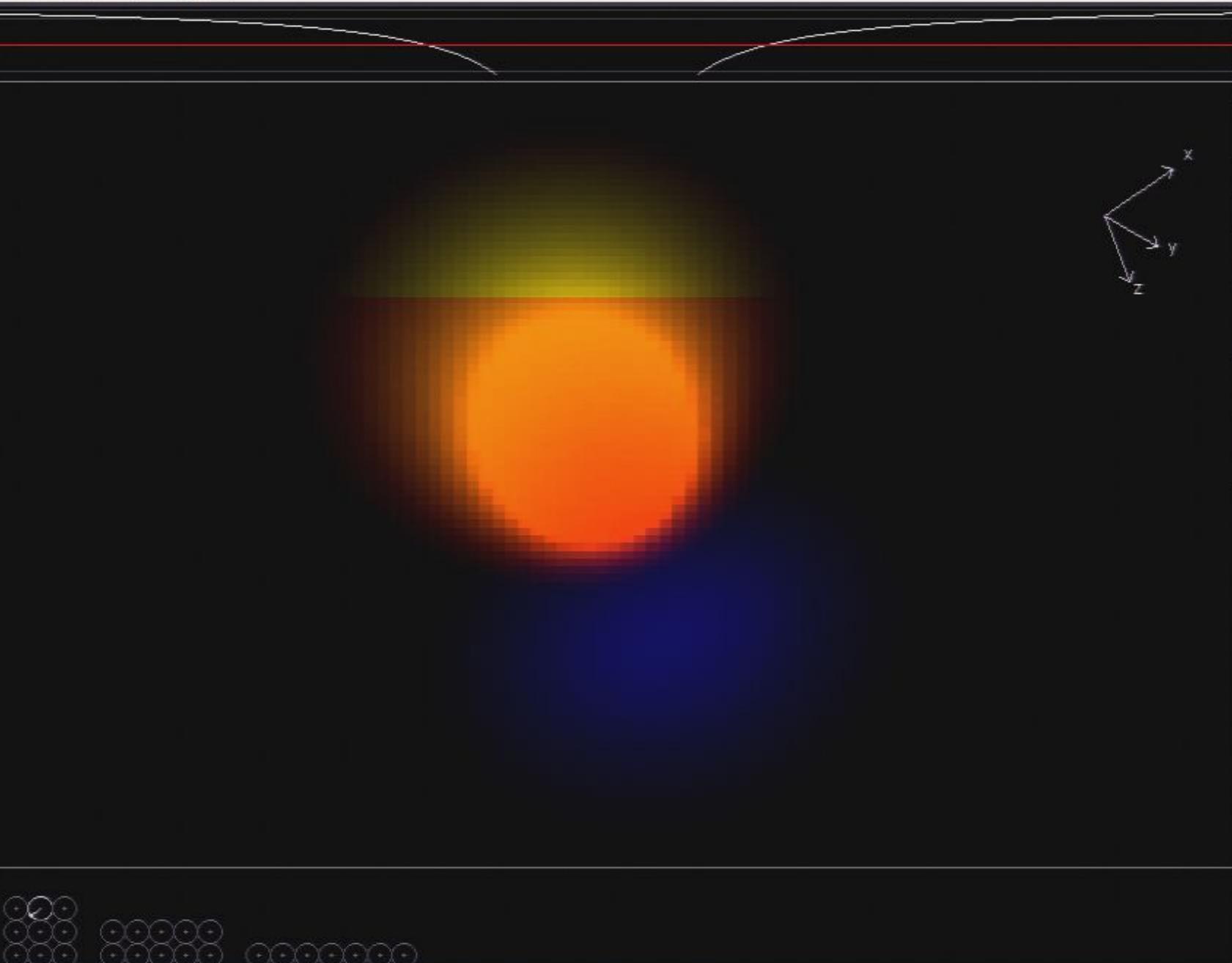
Scale

<http://www.falstad.com>



Hydrogenic Atom Viewer v1.5

View Options Samples



Complex Combos (n=1-4)

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