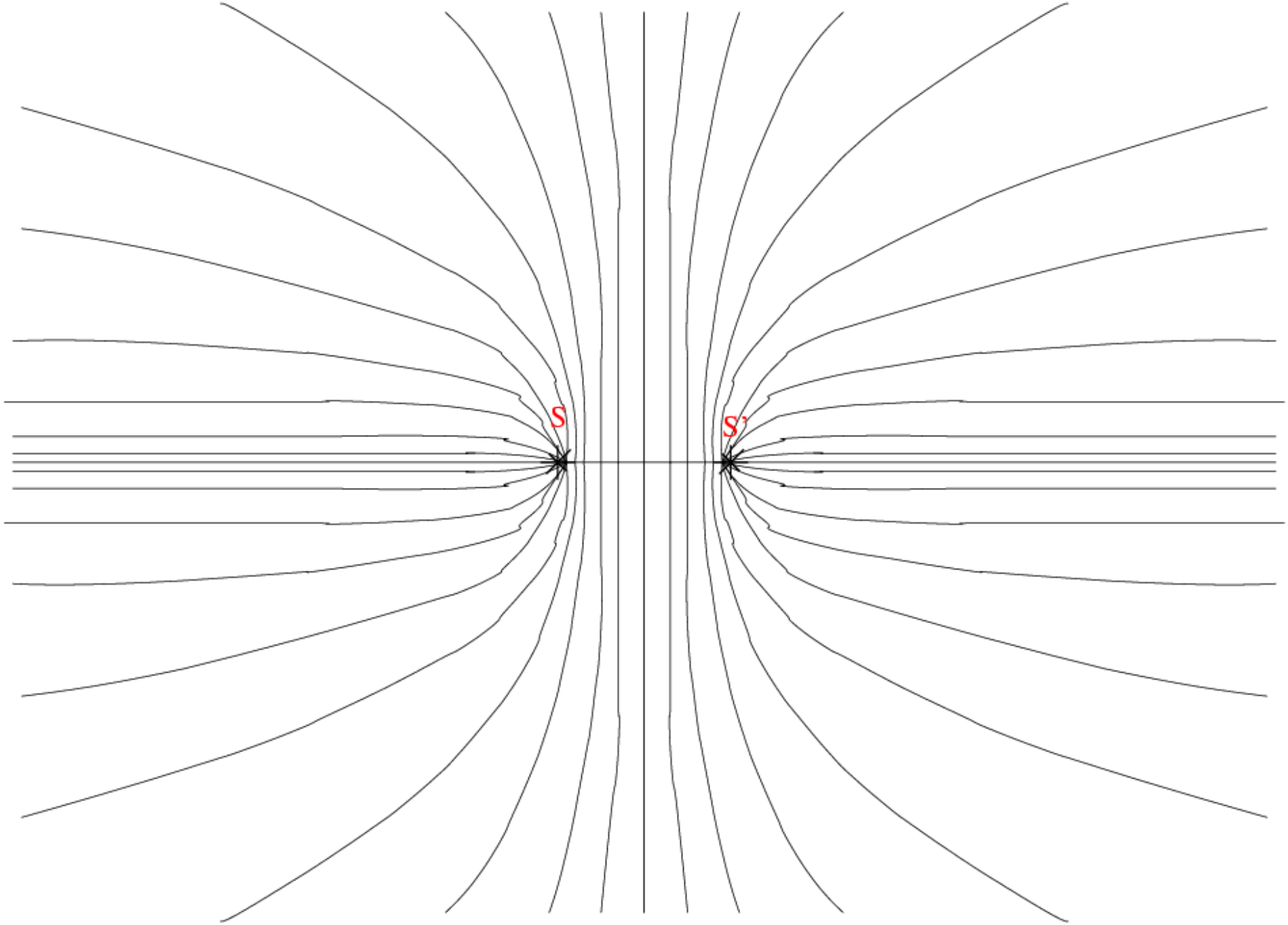
Double slit

A closer look

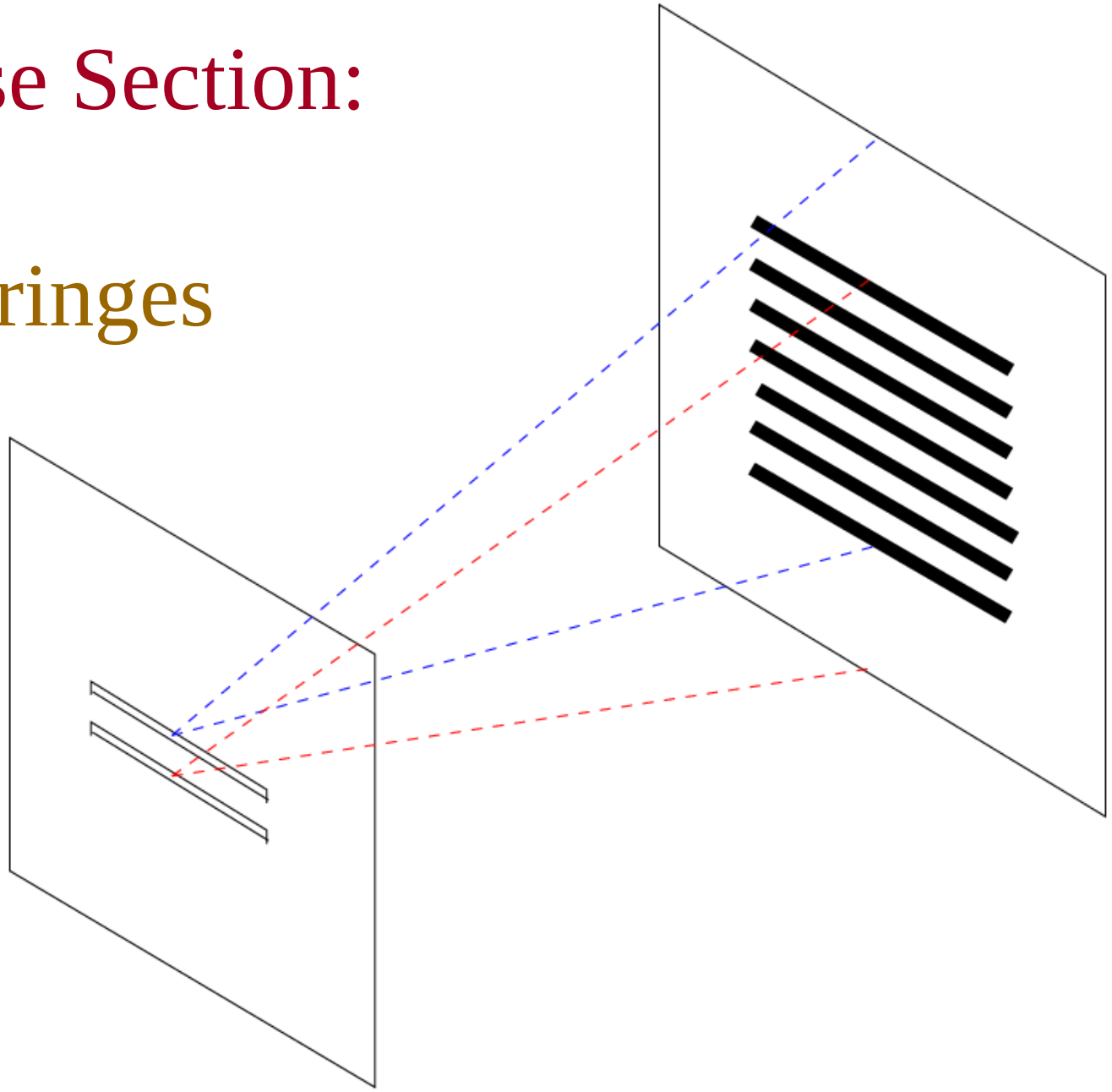
Curves of equal-path difference are

Hyperboloids of revolution


S
S'

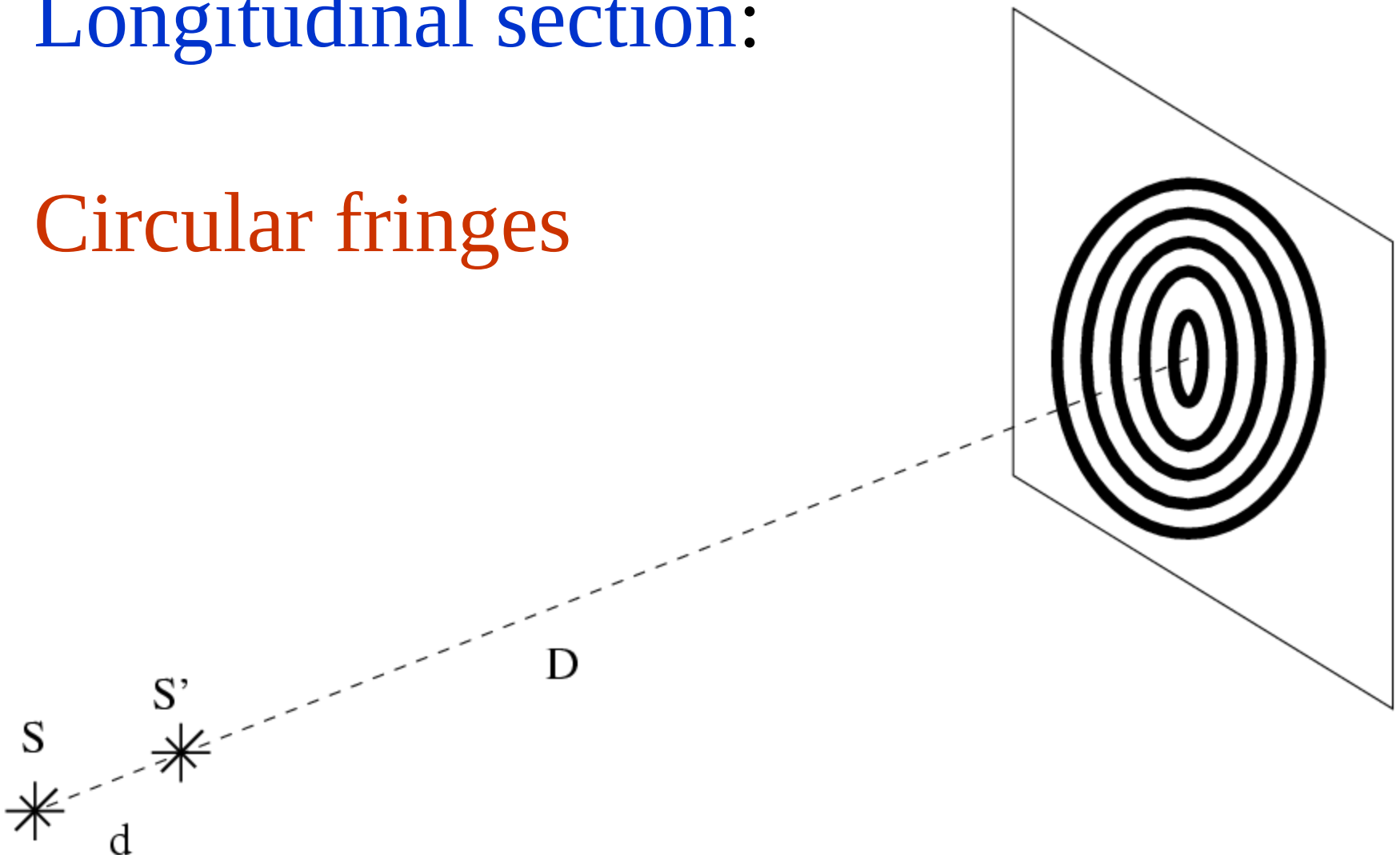
Transverse Section:

Straight fringes



Longitudinal section:

Circular fringes



Wave train

Many sinusoidal nearby frequencies are needed to construct the above

Band of frequencies = $\Delta\nu = 1/(\Delta t)_c$

Temporal coherence:

Coherence time:

$$(\Delta t)_c = 1/\Delta\nu$$

Coherence length:

$$l_c = c(\Delta t)_c$$

Red Cadmium $\lambda = 6438$ A

$\Delta\nu = 10^9$ Hz, $l_c = 30$ cm

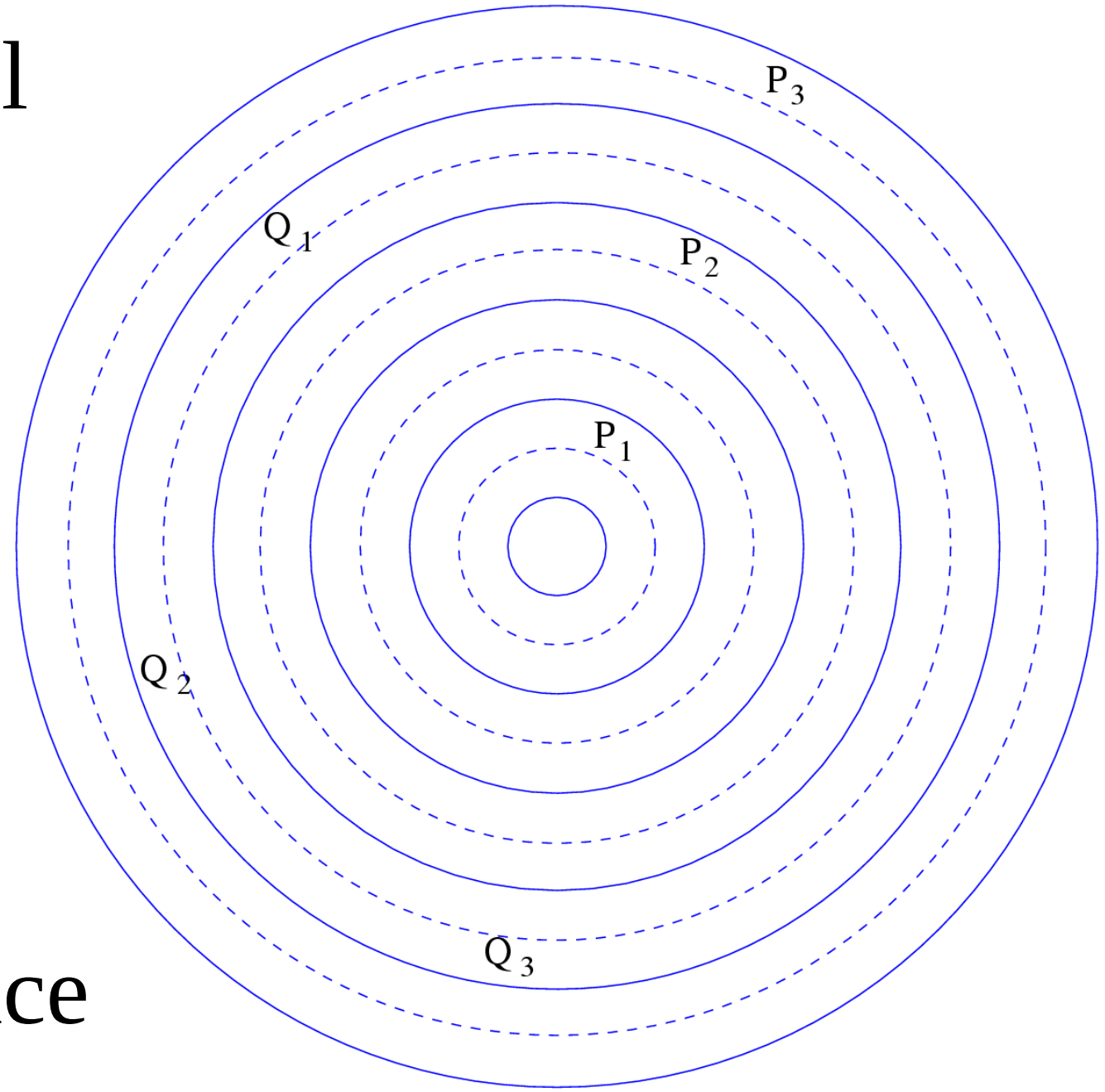
Yellow Sodium $\lambda = 5893$ A

$\Delta\nu = 10^{10}$ Hz, $l_c = 3$ cm

He-Ne Laser $\lambda = 6328$ A

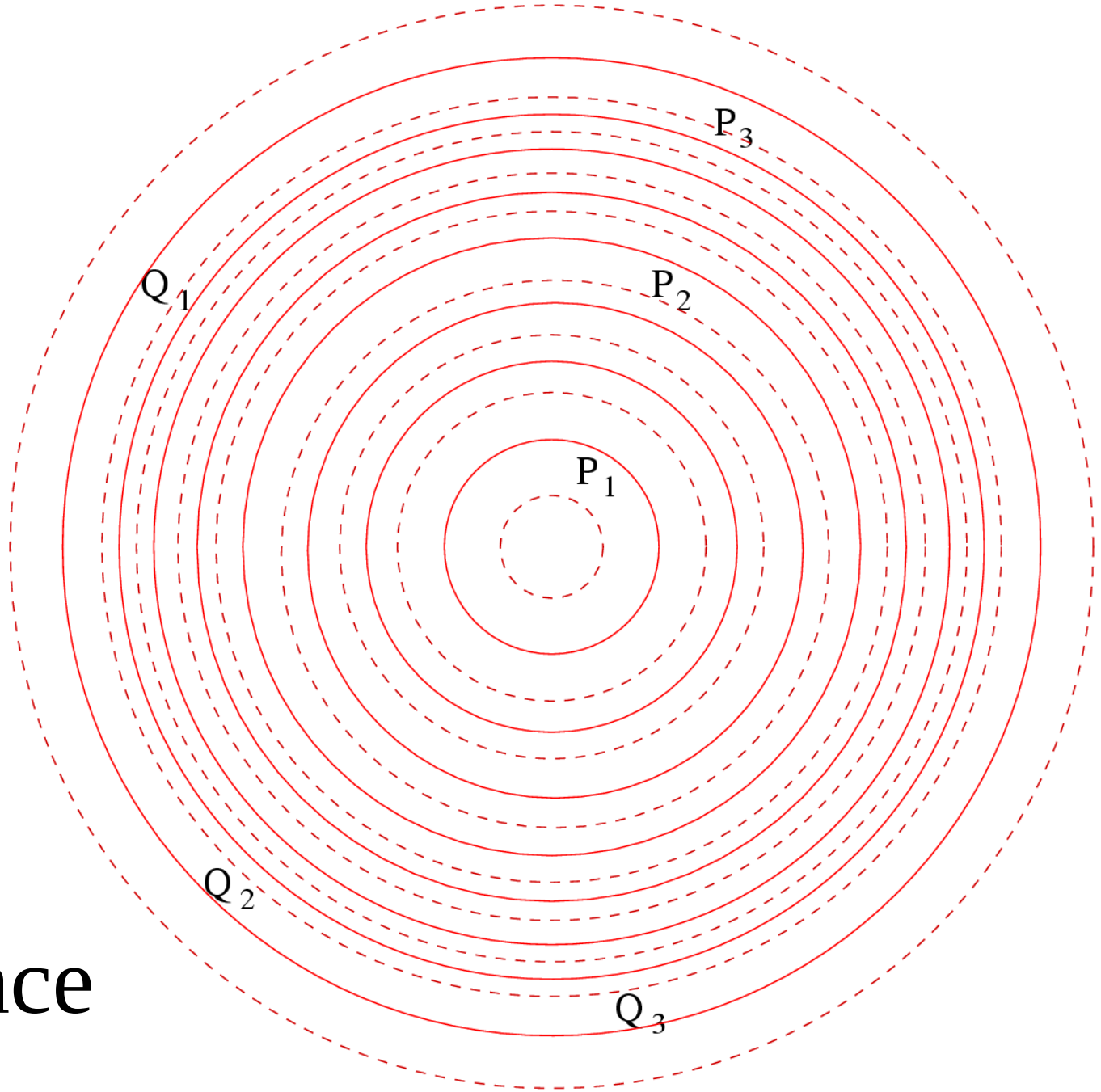
$\Delta\nu = 10^6$ Hz, $l_c = 300$ m

Temporal

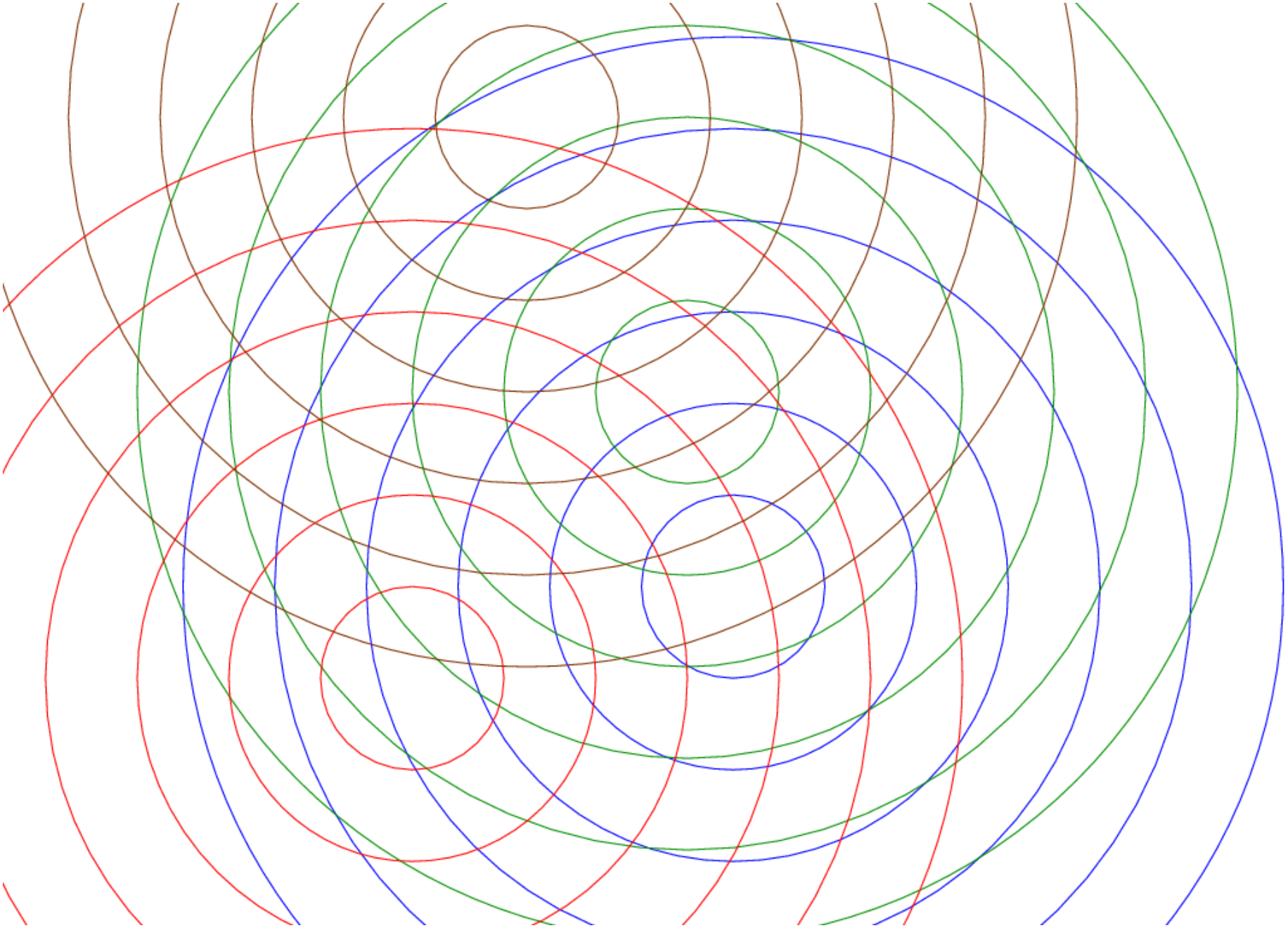


Coherence

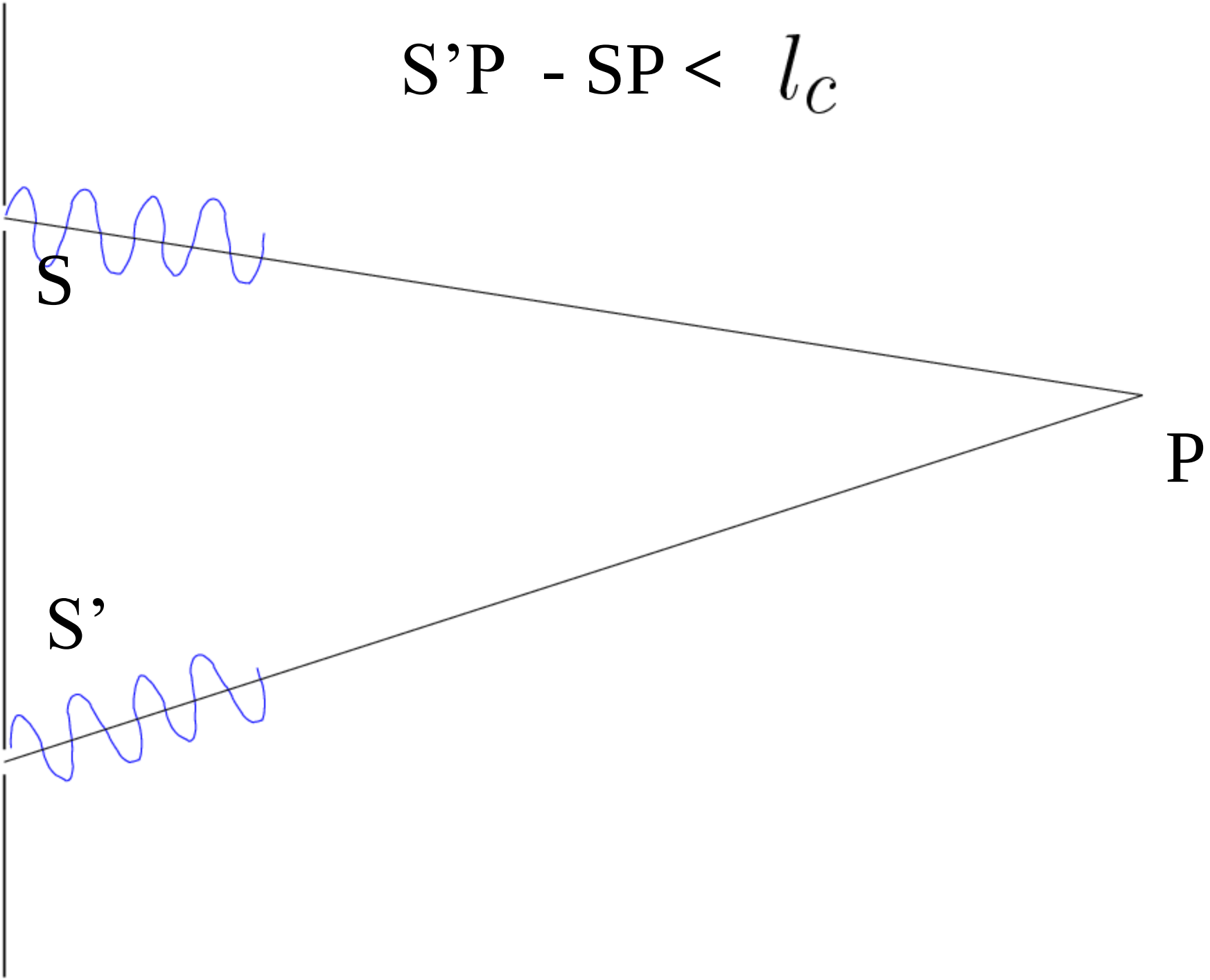
Spatial

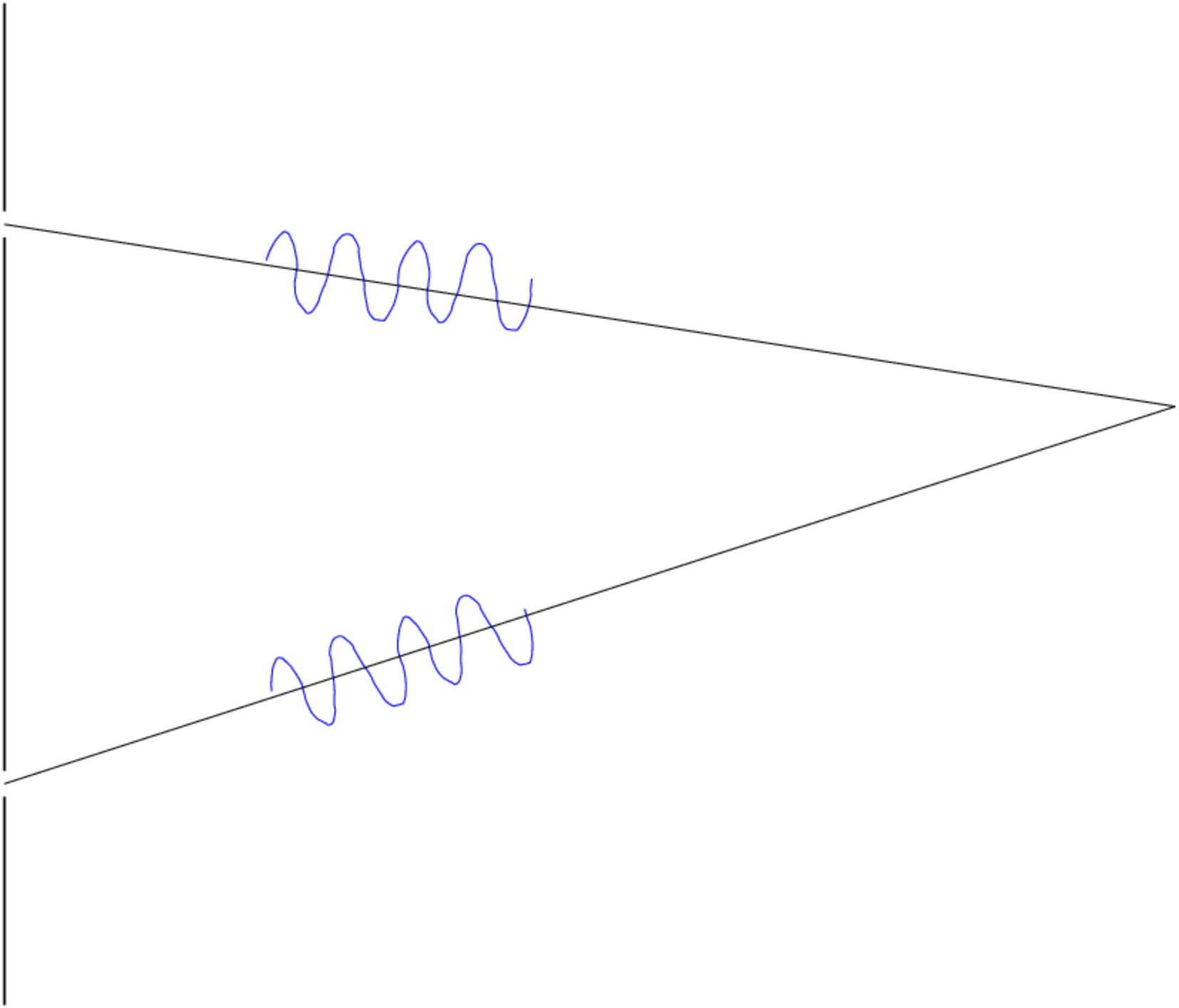


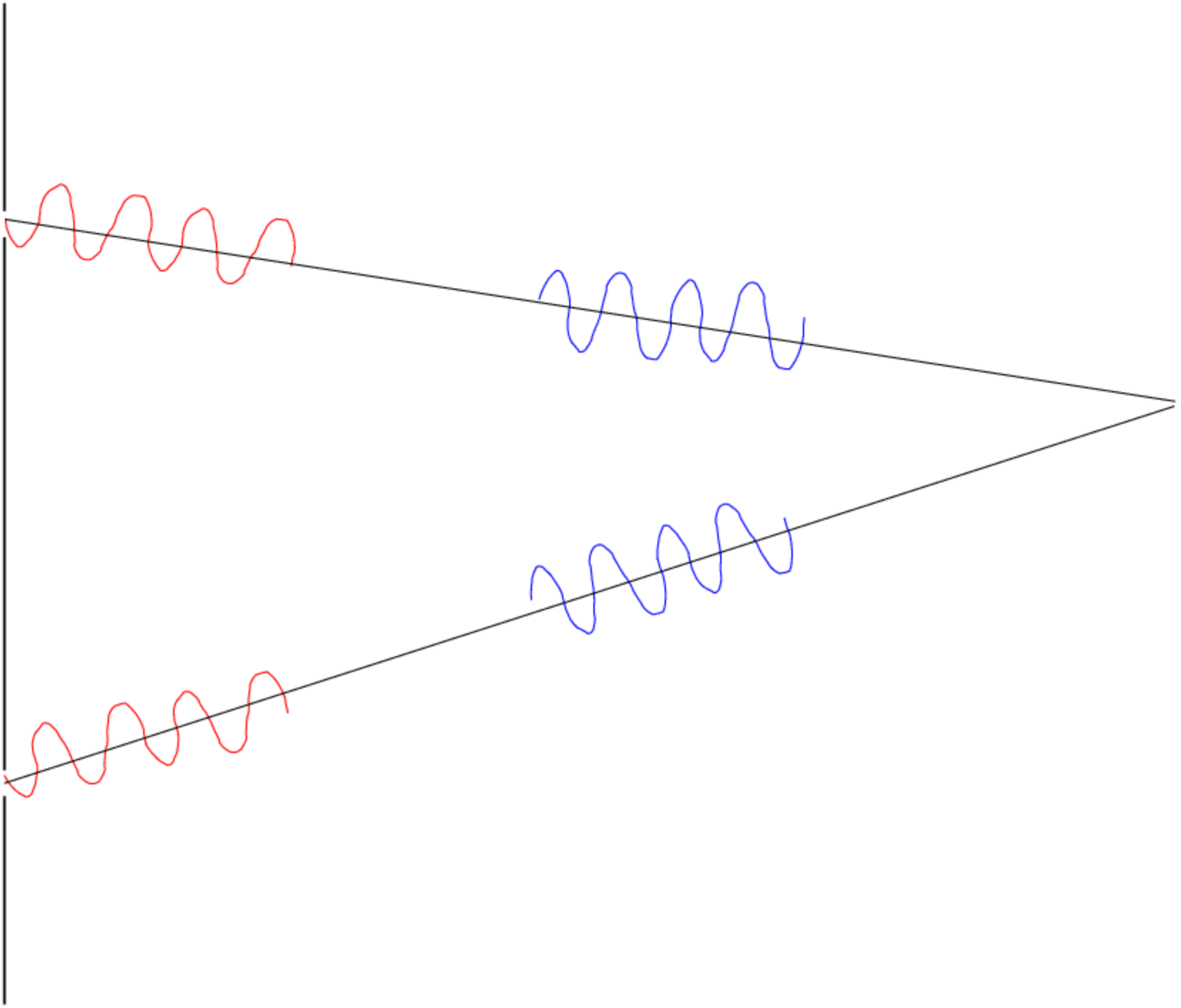
Coherence

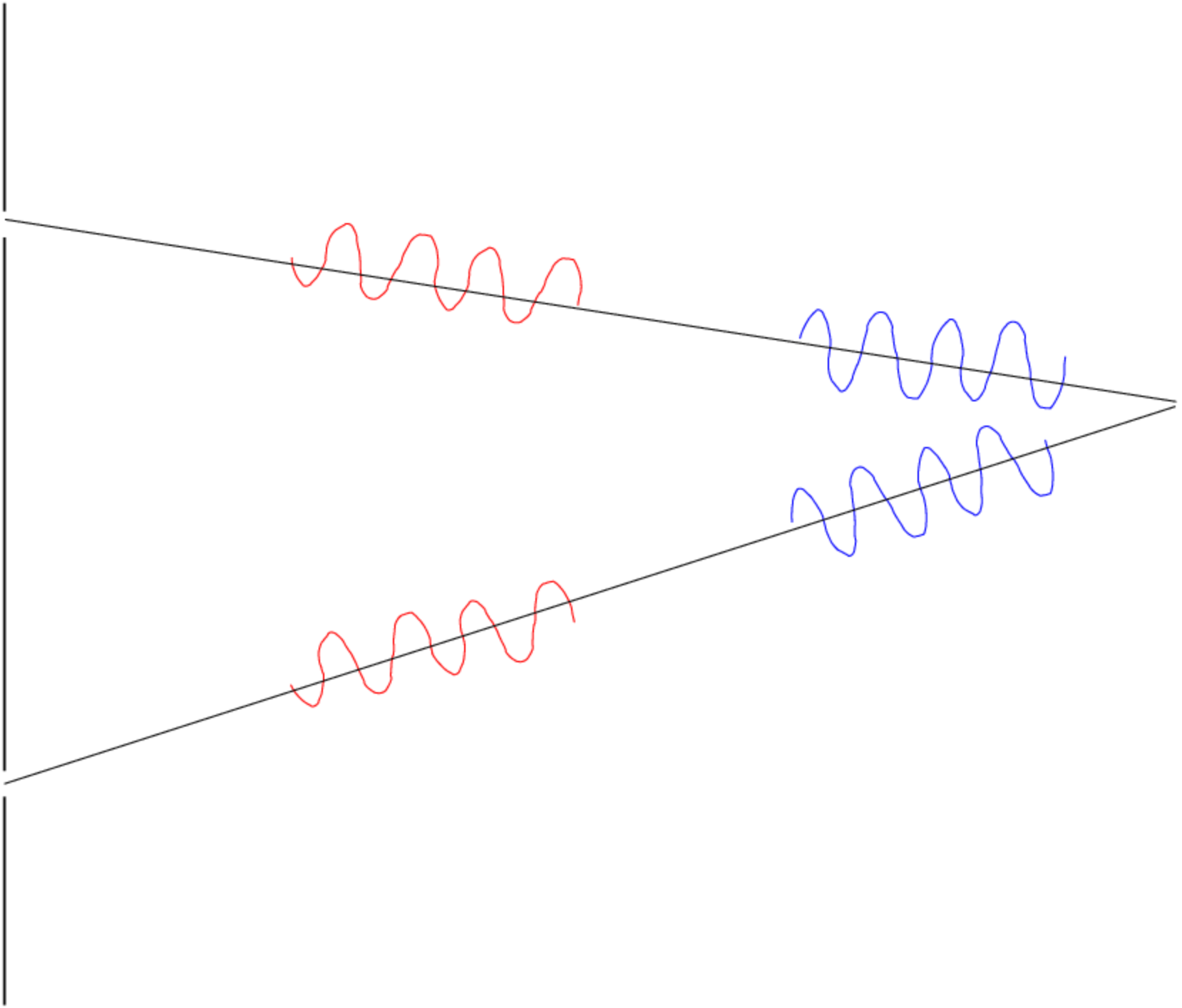


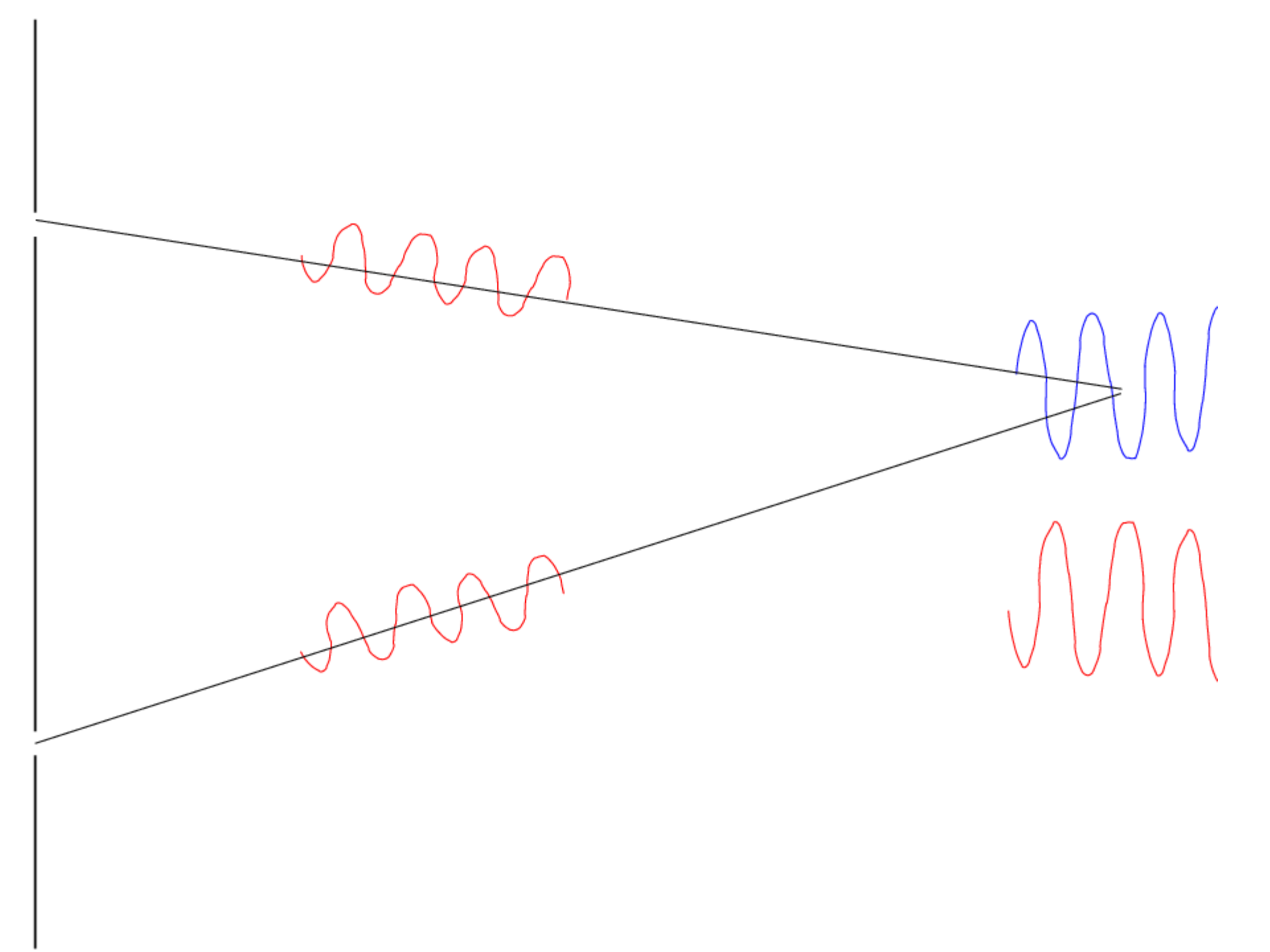
S’P - SP < l_c

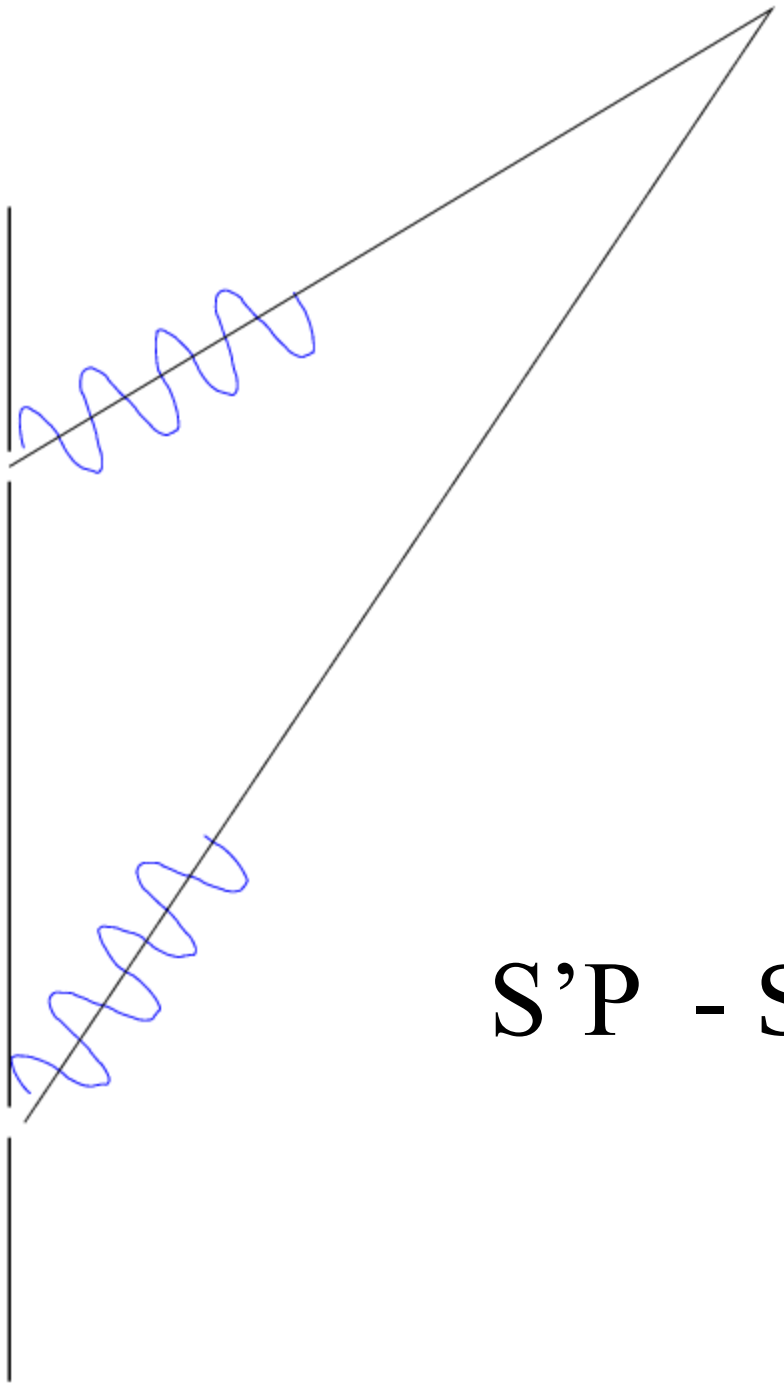




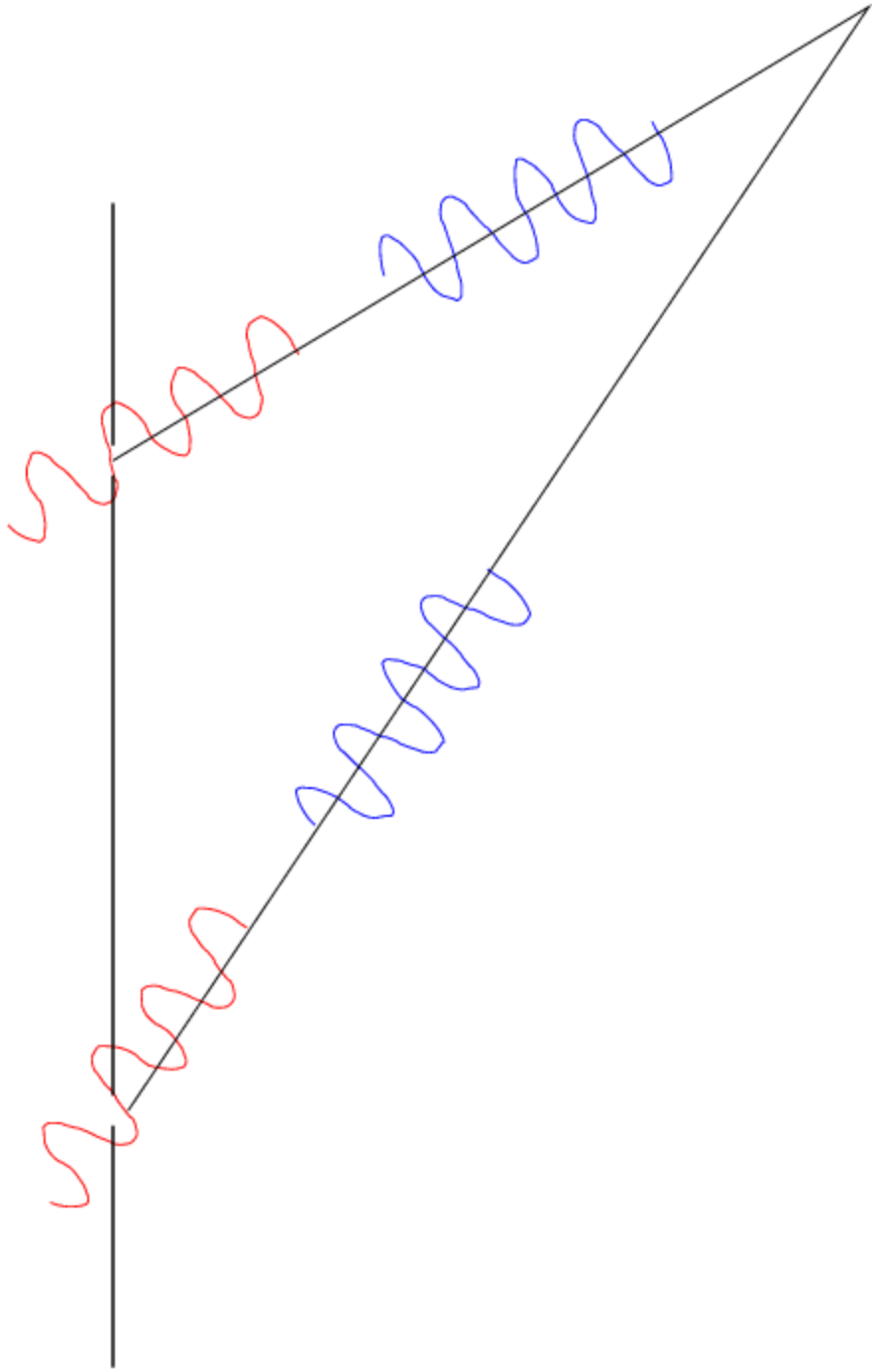


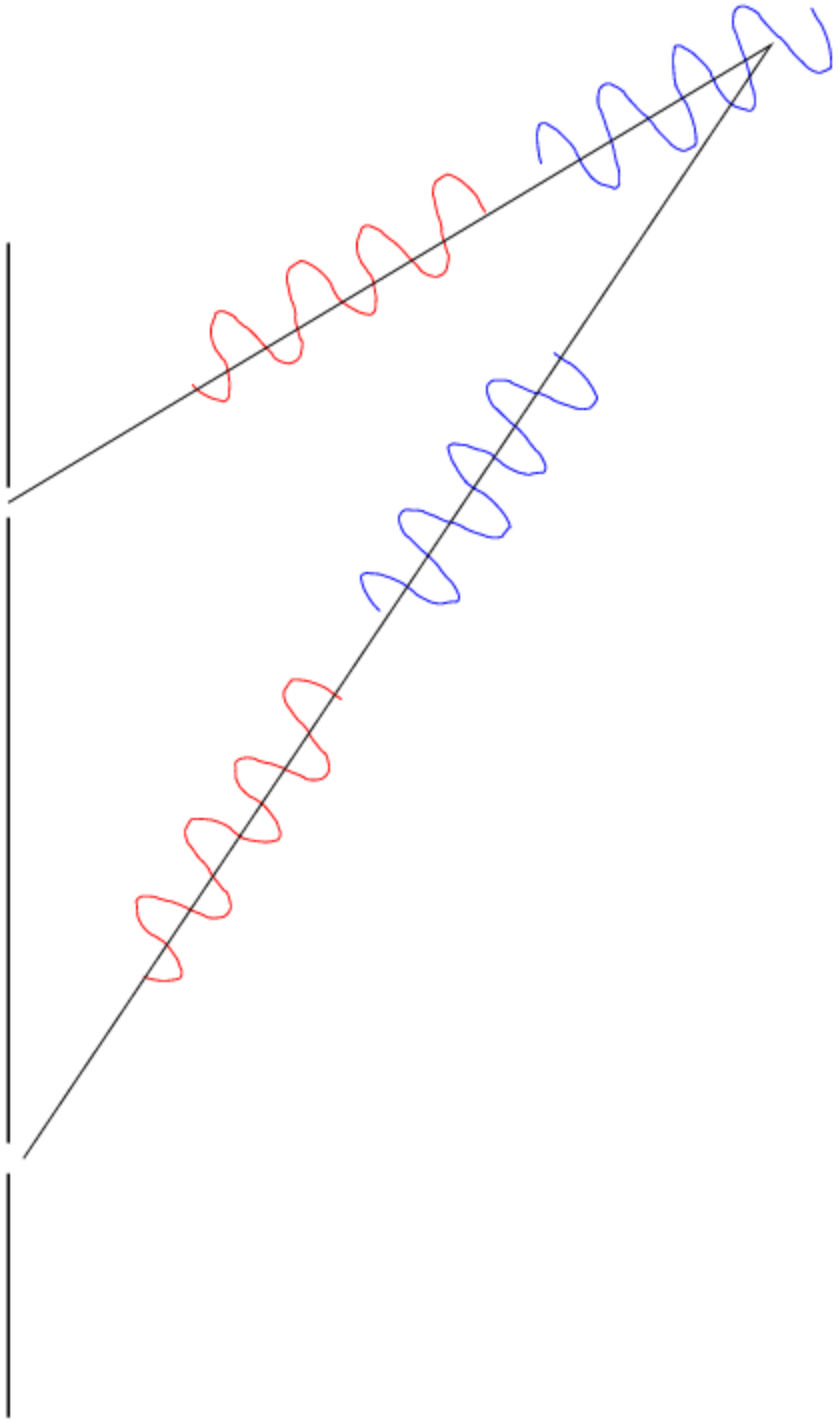


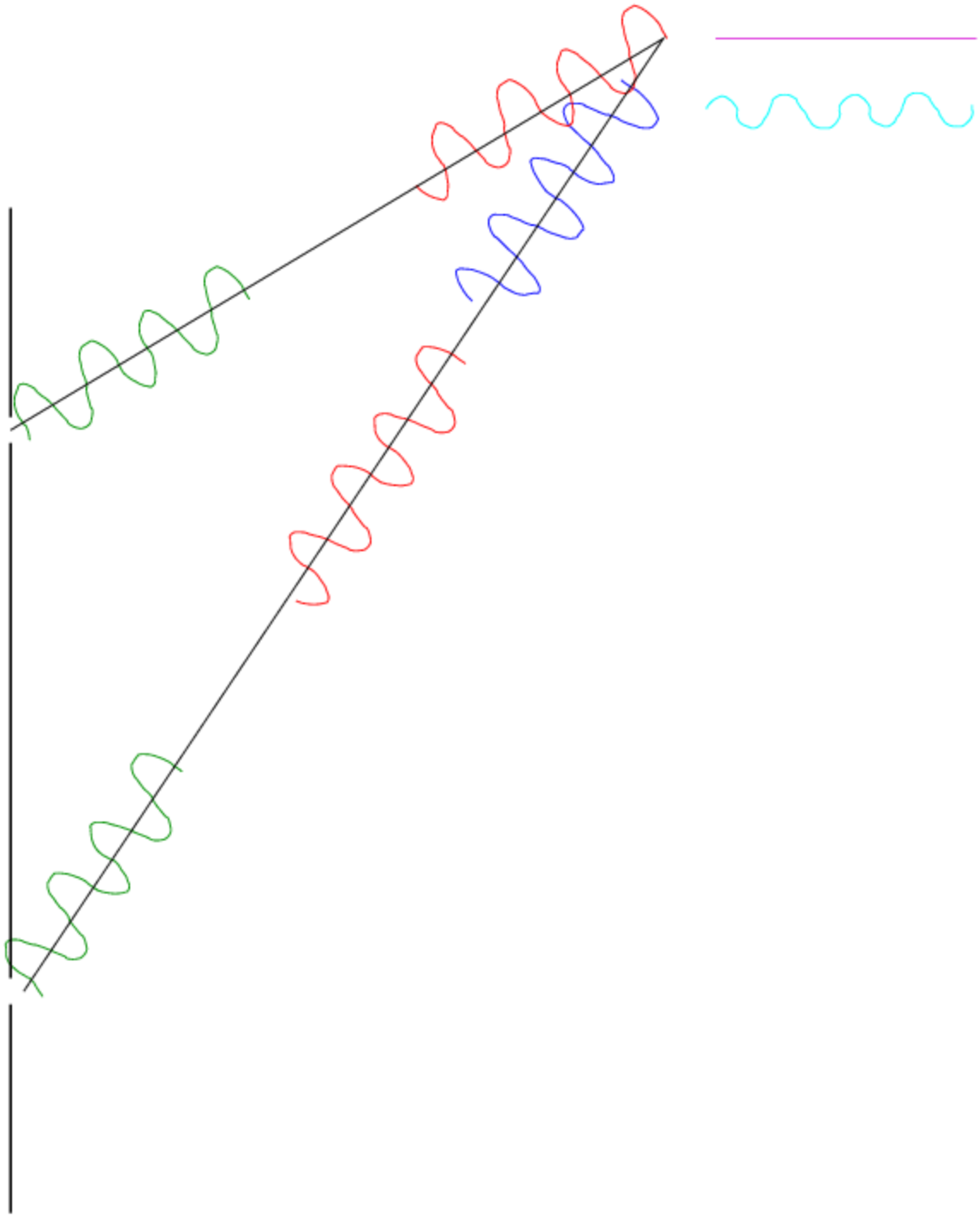




S’P - SP > l_c







Problem: Find the ratio of intensities of dark and bright fringes.

$$\mathbf{E_1} = E_1 \exp(i(\omega t + \phi_1))$$

$$\mathbf{E_2} = E_2 \exp(i(\omega t + \phi_2))$$

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$$\frac{I_{min}}{I_{max}} = \frac{I_1 + I_2 - 2\sqrt{I_1 I_2}}{I_1 + I_2 + 2\sqrt{I_1 I_2}}$$