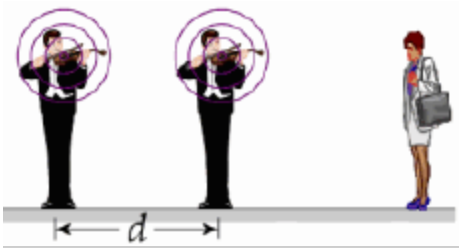
PHYSQ 124 – Particules et ondes. Quiz 11, 4 décembre 2012
Solution

62. **Picture the Problem**: Two violinists separated by a distance *d*, as shown in the figure, play a 440-Hz note.



Strategy: We want to calculate the smallest distance *d*, for which the listener will hear destructive interference. Assume that the violins are in phase with each other. The smallest separation that will produce destructive interference occurs when the separation is equal to one-half of a wavelength. Set the distance to half a wavelength and use equation 14-1 to write the wavelength in terms of the frequency and speed of sound.

Solution: 1. (a) Set the distance equal to half a wavelength:

$$d = \frac{\lambda}{2} = \frac{v}{2f} = \frac{343\text{ m/s}}{2(440\text{ Hz})} = \boxed{0.390\text{ m}}$$

2. (b) The frequency is inversely proportional to the separation distance. Therefore, higher frequency means shorter minimum separation.

3. (c) Solve for the distance at 540 Hz:

$$d = \frac{\lambda}{2} = \frac{343\text{ m/s}}{2(540.0\text{ Hz})} = \boxed{0.318\text{ m}}$$

Insight: In order for the destructive interference to occur, the violins' notes must be coherent and in phase with each other. This typically does not occur during a concert.