Model: Superposition of Waves

Act 8.2.3 FNT's from DLM04 (No activity sheet) (~40 min)

Combine the remainder of Activity 8.2.2 with these FNT's if needed

Learning Goals: See Activity 8.2.2

Model: 2-D Superposition of Waves

Act 8.3.1 Introduction: 2-D Interference Due to Path Length Difference (~50 min)

Learning Goals:

- Develop a graphical method for understanding interference between two waves of two or more dimensions
- Understand that two waves of the same frequency, originating from sources separated from one another, create an alternating pattern in space of constructive and destructive interference
- Recognize that this spatial interference pattern is the direct result of difference between the path lengths measured from every point back to each wave source
- Recognize that, as with the previous 1-D case, the total phase difference $\Delta\Phi$ at each point in 2-D or 3-D space determines whether constructive or destructive interference occurs

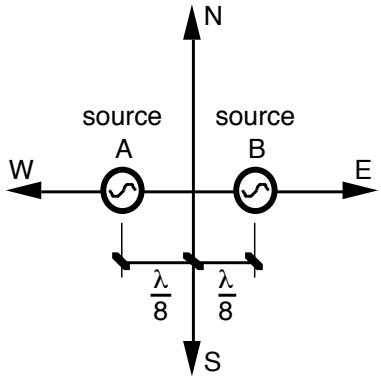
Act 8.3.2 Interference with Microwaves (~45 min)

Learning Goals:

- Recognize that microwaves are types of harmonic waves, so are thus subject to interference phenomena
- Investigate in two dimensions the spatial interference pattern resulting when two coherent microwaves of the same frequency are superposed
- Reinforce the idea that when two waves of the same frequency and fixed phase constant are superposed, the interference depends only on the difference between path length to each source

Model: 2-D Superposition of Waves

1. (Application) Suppose KDVS, the campus radio station, were to transmit from two antennas set $\lambda/4$ apart (see figure). Also, suppose there is a constant phase difference $\Delta\varphi$ associated with the waves coming from each antenna: the phase of the waves from antenna A is $\pi/2$ (90°) *ahead* of antenna B.



(a) For each of the four principal compass points of north (N), south (S), west (W), and east (E), determined whether the signals from the two antennae interfere:
constructively; destructively; or partially.
Justify your answers using a phase chart **and** written sentence.

(b) Why might KDVS decide to transmit its signal in this manner, instead of from just one antenna? *Where* would KDVS locate its transmitters if it "phased them" like this (e.g., northern Davis)?

2. (Challenge) Suppose there were three evenly spaced slits (as in the drawing) such that all three slits acted as wave sources.

Once you found one of the maxima (constructive interference location) for the first two slits, would the third wave constructively interfere with wave 2 at that location? Would wave 3 constructively interfere with wave 1? (Hint: Make sure that you consider the path length difference, Δx, for all ***three*** pair of waves.)