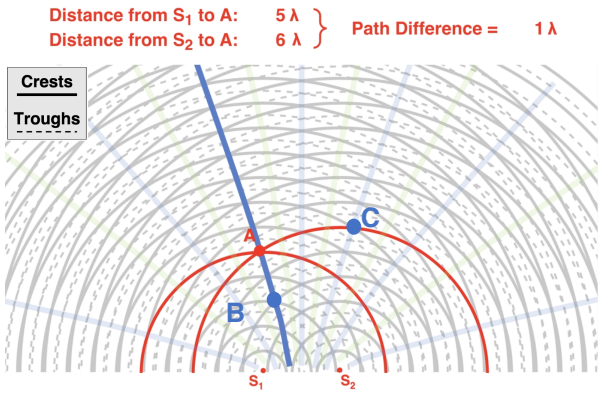
Path Difference and Wavelength
Lesson Notes

Learning Outcomes

- What is path difference and how is it related to the wavelength for points on antinodal and nodal lines?

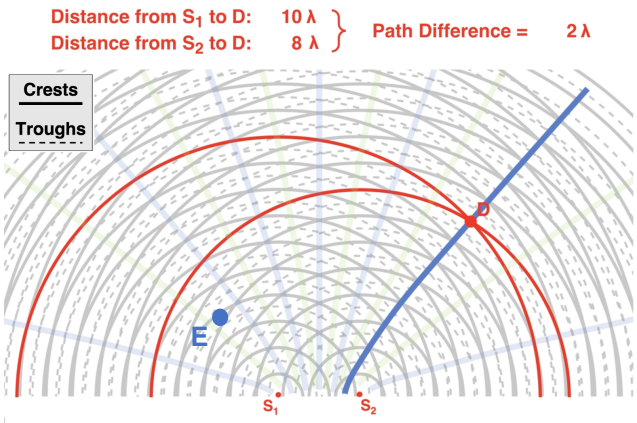
Analyzing the First Antinodal Line (m = 1)



1st Antinodal Line

	S_1P	S_2P	PD
A	5λ	6λ	1λ
B	3λ	4λ	1λ
C	7λ	6λ	1λ

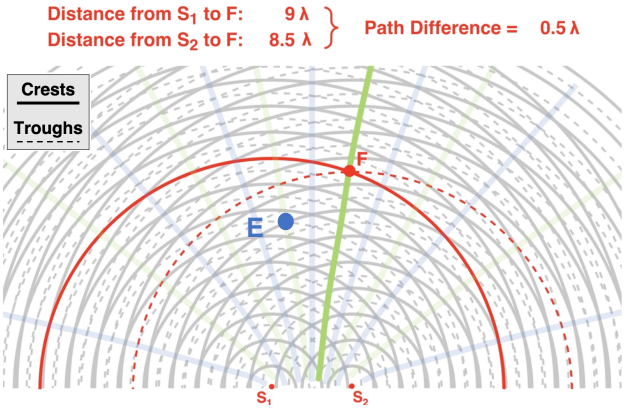
Analyzing the Second Antinodal Line (m = 2)



2nd Antinodal Line

	S_1P	S_2P	PD
D	10λ	8λ	2λ
E	4λ	6λ	2λ

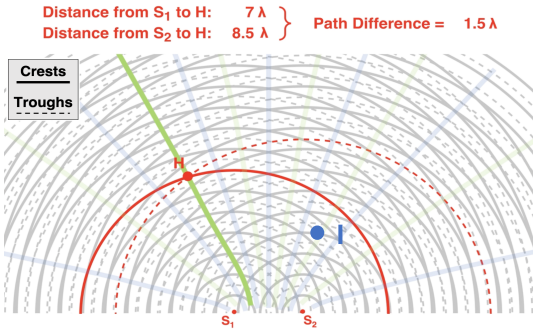
Analyzing the First Nodal Line (m = 0.5)



1st Nodal Line

	S_1P	S_2P	PD
F	9λ	8.5λ	0.5λ
G	6.5λ	7λ	0.5λ

Analyzing the Second Nodal Line (m = 1.5)



2nd Nodal Line

	S_1P	S_2P	PD
H	7λ	8.5λ	1.5λ
I	5.5λ	4λ	1.5λ

Data Summary

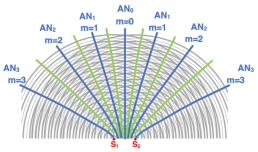
Line	m	PD
Central Antinodal Line	0	0•λ
1st Antinodal Line	1	1•λ
2nd Antinodal Line	2	2•λ
3rd Antinodal Line	3	3•λ
1st Nodal Line	0.5	0.5•λ
2nd Nodal Line	1.5	1.5•λ
3rd Nodal Line	2.5	2.5•λ

Generalized Equations

For **Antinodal Lines**:

Path Difference = **PD = m•λ**

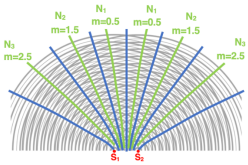
where m = 0, 1, 2, 3, 4, … (antinodal line #)



For **Nodal Lines**:

Path Difference = **PD = m•λ**

where m = 0.5, 1.5, 2.5, 3.5, … (nodal line #)



Making Sense of PD Equations

Antinodal lines are locations where constructive interference occurs; the **path difference** must be a whole number of wavelengths in order for crest to meet crest or trough to meet trough.

Nodal lines are locations where destructive interference occurs; the **path difference** must be a half number of wavelengths in order for a crest from one source to meet a trough from the other.