A few notes on bars and drums

Physics 200
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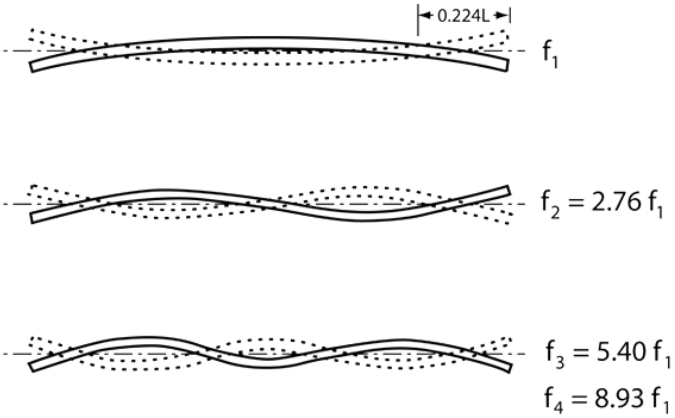
YAMAHA


ADAMS

How do we make musical notes with a metal/wooden bar?



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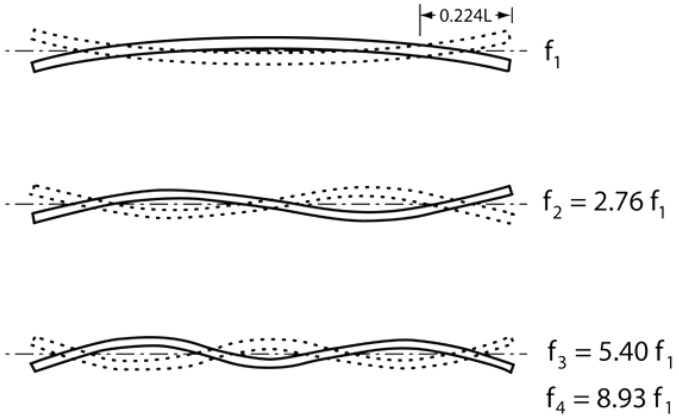
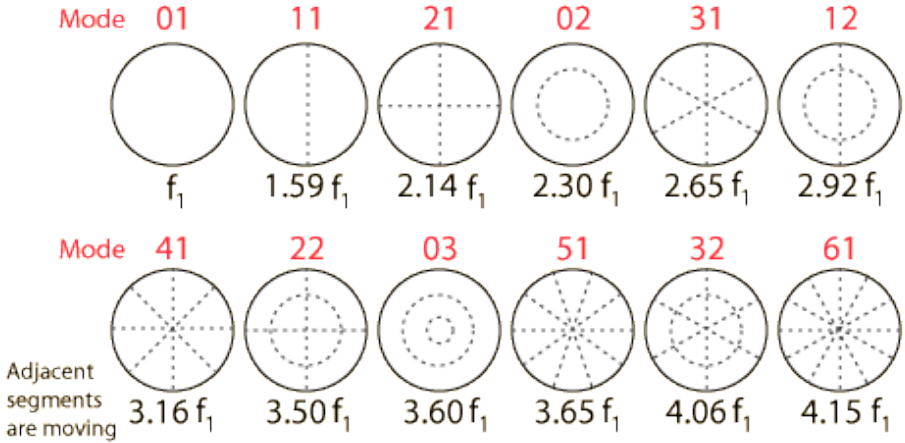


I'll let you all figure this one out!

- Glockenspiel ("bell-player"): bars made of metal
- Xylophone ("wood-sound"): bars made of wood
- Marimba: additional resonating tubes near each bar to amplify fundamental
- Vibraphone: use a motor to move things around in the tubes, creating vibrato/tremolo

How does a circular membrane vibrate?



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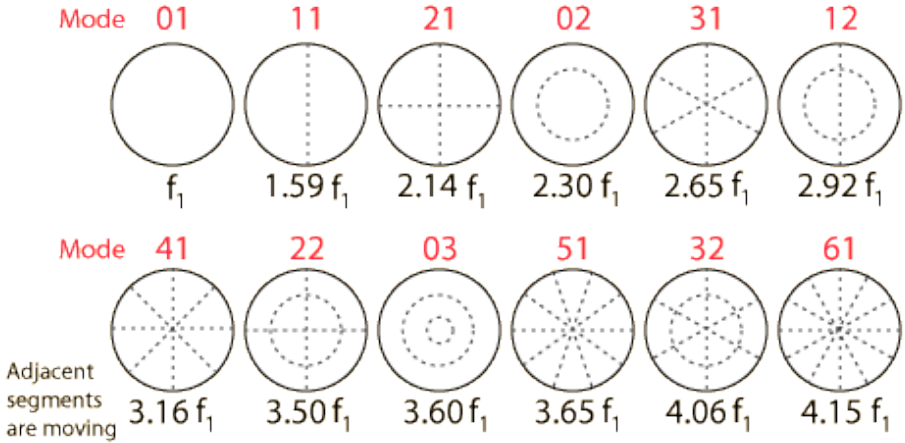

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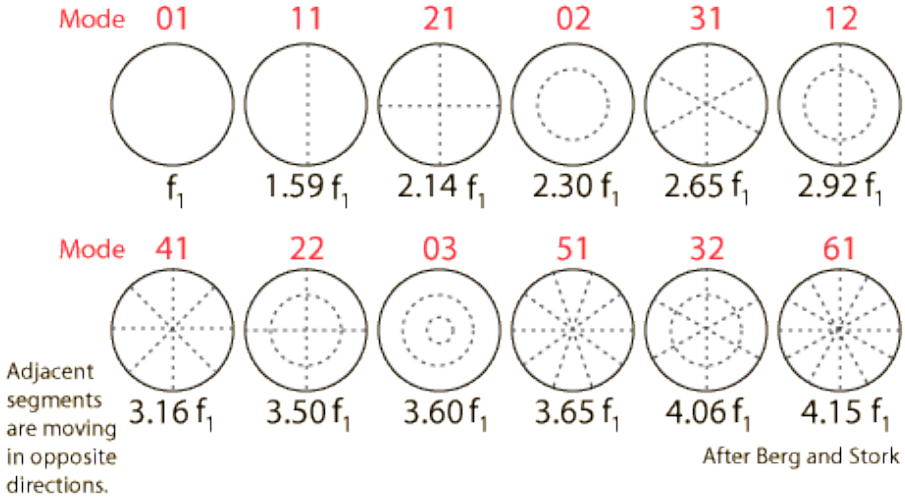
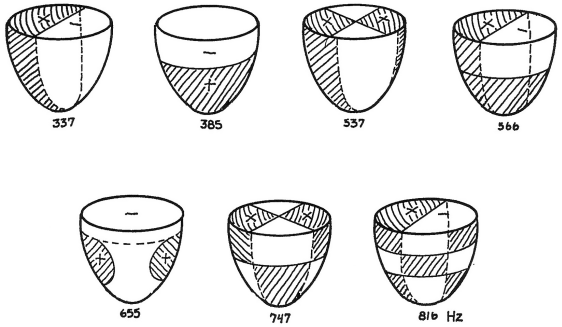


This is not a harmonic series...

How do we make harmony out of this mess?

- Some modes might be suppressed (as in the marimba)
  - Turns out radially-symmetric ones are suppressed strongly, particularly (0,1)
  - Other modes can be suppressed by beating at a nodal point
- "Retune" the others by modifying the membrane?

Largest effect: coupling between membrane and vibration of air



Mode	Theoretical	Actual
0,1	—	—
1,1	**1.00**	**1.00**
2,1	**1.35**	**1.504**
0,2	—	1.742
3,1	**1.67**	**2.000**
1,2	—	2.245
4,1	**1.99**	**2.494**
2,2	—	2.800
0,3	—	2.852
5,1	**2.30**	**2.979**
6,1	**2.61**	**3.462**

Another effect: not-quite-uniform tension across the head