



# String Instruments

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# History

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- ❖ Bowed String Instruments date back to medieval times and perhaps earlier
- ❖ The viol family emerged first and was overthrown by the violin family in the 16th and 17th centuries
- ❖ The Violin, Viola, Cello, and Bass of the violin family are still used widely today as the backbone of the orchestra

# Viola de gamba vs. Violin

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# External Components of Violin

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- ❖ Four steel or gut strings tuned in fifths (except the basses who tune in 4ths)
- ❖ Ebony Fingerboard/ Neck
- ❖ Nut
- ❖ Tailpiece
- ❖ Bridge
- ❖ Top/ Back/ Sides (Ribs)
- ❖ Peg box/ Scroll/ Tuning Machines
- ❖ Endpin for Cello and Bass

# Internal Components of Violin

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- ❖ Sound Post
- ❖ Bass Bar
- ❖ These serve critical support roles as well as acoustic ones

# Tuning of Top and Back Plates

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- ❖ Violin makers will take the tops and backs of violins in progress and tap them to listen to their pitch
- ❖ The top and back act as Chladni Plates, and nodal lines can be detected

# Plucked Strings

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- ❖ Plucking a string at its halfway point tends to excite modes that are odd numbered harmonics of the fundamental
- ❖ Two identical pulses propagate in opposite directions away from the center
- ❖ Modes 3,7,11,etc must be opposite in phase of 1,5, and 9 in order to give a maximum at the center
- ❖ Plucking in different areas on the string will result in different harmonics dampened / excited

# Bowed Strings

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- ❖ Stick and Slip
- ❖ A bowed string has a sawtooth shape; a nearly straight string with a sharp bend that propagates up and down the string. Direction of bend is determined by bow direction

# Violin like a Speaker

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❖ <http://www.youtube.com/watch?v=xVguI1HvWPo>

# Fret Compensation in Guitars

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- ❖ Equal Temperament semitones correspond to frequency ratios of 1.05946, very near 18:17
- ❖ The “rule of eighteen” states that frets should be placed  $1/18$  the remaining distance to the bridge
- ❖  $18/17$  equals 1.05882 (about .06% error), resulting in slightly flat notes
- ❖ At the octave, the note would be 12 cents flat, which is noticeable
- ❖ 17.817 should be used instead of 18

# Fret Compensation in Guitars

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- ❖ Pressing a string down against a fret causes tension, especially in the case of steel strings
- ❖ The fretted notes will sound slightly sharper than the open notes
- ❖ The nut to saddle length is made slightly longer than the fret length scale to compensate for this. It is usually 1 to 5 millimeters

# Rolling Shutter Effect

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- ✧ <http://www.youtube.com/watch?v=TKF6nFzpHBU>
- ✧ <http://www.youtube.com/watch?v=MoUQdcLmz5g>