Musical Physics

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TRIUMF Public Workshop

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Nicolas Lupot
Violin

Paris, 1808

Arpa Cromatica a tre file, C17th, Museo Civico, Bologna

The Plan

- The nature of sound
- Frequency (pitch and scales), loudness
- Waves on a string
- Frequency analysis and synthesis
- Sounds of real instruments
- (Making a musical instrument)
- (Sound detection – the ear)
- (Sound recording)

Waves in air and on strings

- PhET simulations

http://phet-web.colorado.edu/web-pages/simulations-base.html

- or just Google “phet”

Frequency (Fourier) Analysis

- www.audacity.com (waveform and frequency)
- www.shakuhachi.com (tuner)
- www.baudline.com (linux only)

All freeware

Two Languages: Physics & Music

- Audio range 20Hz-20kHz.
- Harmonic series => natural scale based on factors 4/3 (“fourth”), 3/2 (“fifth”) and 2 (“octave”).
- Further division less obvious;

  - one possibility for a single tone is 9/8
- Western equal-temperament scale is mix of tones ($2^{1/6} \cong 1.12$) and semitones ($2^{1/12} \cong 1.06$).
- Notation:

  C_4(262Hz), D_4, E_4, F_4(4^{th}), G_4(5^{th}), A_4(440Hz), B_4, C_5(524Hz), D_5, etc.