

Issac Newton (1643-1727)



Key points

Stringed instrument

Baroque style

Harmony

Equal temperament

Frequency

Isaac Newton

Music/colour analogy

Sound and wave

Lesson 6 Baroque (1600-1750) and Science

Development of stringed instrument : harpsichord

- **JS Bach wrote melodies, especially in concert with other instruments.**
 - ***Fifth Brandenburg Concerto***
- **Domenico Scarlatti wrote 555 pieces for the instrument.**
- **Rhythms and dramatic pauses to intensify the music.**
 - **Bach's 'Toccatà and Fugue in d minor'.**



what is Baroque style?

- **Affect the soul, bring emotion to the music, Joy, sorrow, love, hate, wonder, and desire.**
- **Influence of scientific and philosophical changes.**
- **Isaac Newton theorized the laws of gravity**
- **Royal courts were growing richer and more powerful**



the German organist Johann Pachelbel (1653-1706).
Antonio Vivaldi (1678-1741),
in England, Henry Purcell (1659-1695)
George Frideric Handel (1685-1759)
German composer Johann Sebastian Bach (1685-1750).

Tonal Harmony ?

- **Major and minor tonalities.**
- **Offer clear expression of the affections**
- **Decorate the melodies with the harmonies.**
- **Basso Continuo 通奏低音**
- **the use of ornamentation**
- **Use driving rhythms and dramatic pauses to intensify the music Rhythm**
- **Bach's 'Toccatà and Fugue in d minor**

Equal temperament 平均律

- a musical temperament or a system of tuning, in which the frequency interval between every pair of adjacent notes has the same ratio.
- There are equal ratios of the frequencies of any adjacent pair, since pitch is perceived roughly as the logarithm of frequency
- Equal perceived “distance” from every note to its nearest neighbor.
- 1オクターヴなどの音程を均等な周波数比で分割した音律。一般には12平均律を指す。
- 音程(Interval<インターバル>)とは、二つの音の高さの隔たりのこと。順次的に鳴る音に対する音程を旋律的音程と呼び、同時に鳴る音に対する音程のことを和声的音程と呼ぶ。
- 全音階を構成する8度までの単音程の組み合わせによって、あらゆる音程を構成できる。
- Temperament (音律), tuning (音合わせ)

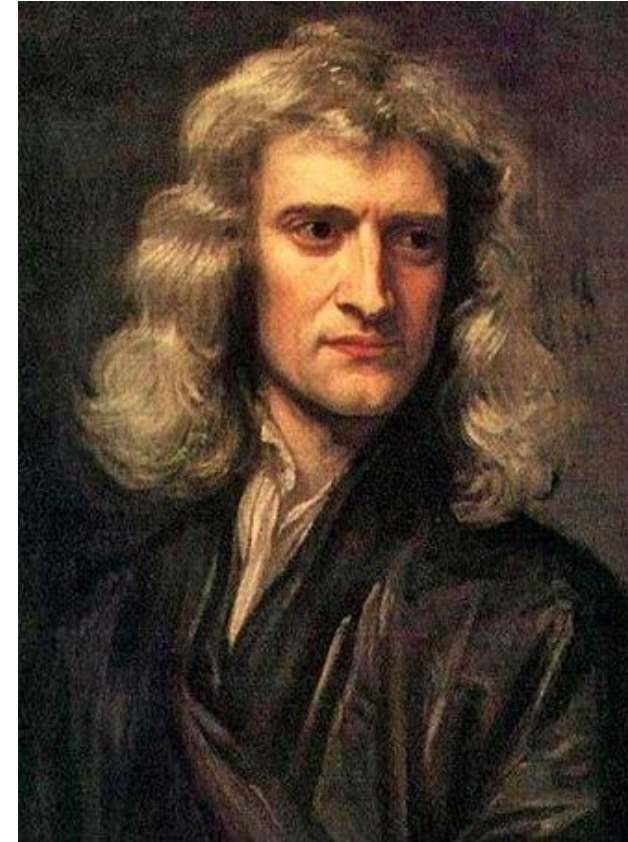
The Well-Tempered Clavier

*Each set contains
twenty-four pairs of
prelude and fugue.*



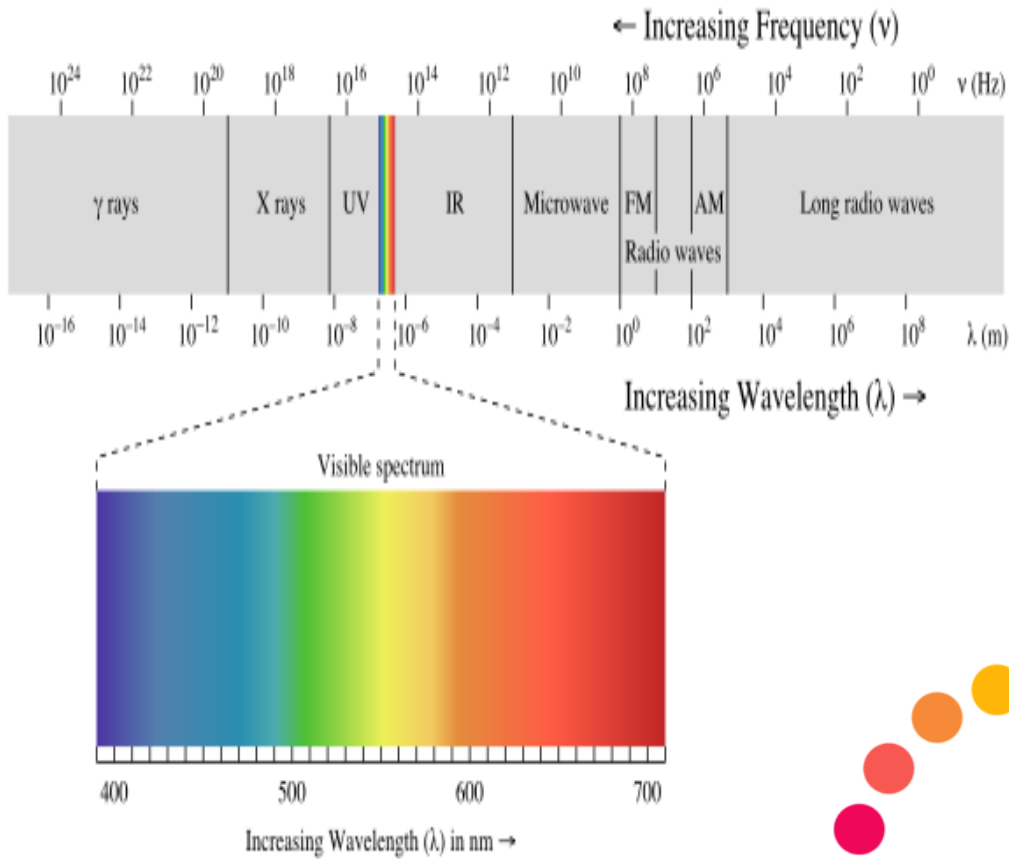
Sir Isaac Newton 1642 - 1726)

**English mathematician, astronomer, theologian, physicist (as a "natural philosopher")
a key figure in the scientific revolution.**

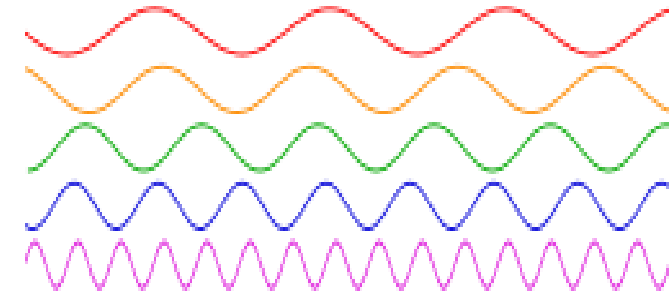


Newton and the music/colour analogy

- **Isaac Newton's manuscript 'Of Musick' :his analogy between music and colour. This manuscript shows that Newton's musical judgements relied on experiential qualities, on 'sweetness' or 'gratefulness', than on purely theoretical preconceptions.**
- **In his *Opticks*, Newton used this analogy in his optical writings to define seven spectral colours analogous to the seven tones of the diatonic scale, implicitly presuming that the spectrum, like the scale, spans an octave.**
- **Newton restored the primacy of the octave in his analogy .**



Visible light is an electromagnetic wave consisting of oscillating electric and magnetic fields traveling through space.
 可視光とは、空間を電磁波の形で電波するエネルギーのこと。



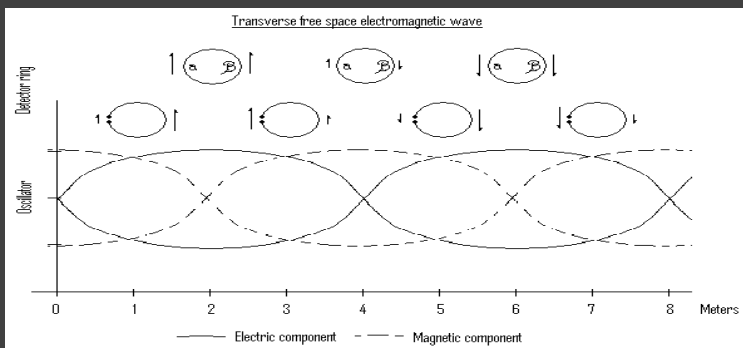
Frequency is the number of occurrences of a repeating event per unit of time

Sound = wave

In **physics**, sound is a **vibration** that typically propagates as an **audible** wave of pressure,

In human **physiology** and **psychology**, sound is the *reception* of waves and their *perception* by the **brain**. Humans can only hear sound waves as distinct pitches when the **frequency** lies between about 20 Hz and 20 kHz. Sound waves below 20 Hz are known as **infrasound**.

Audible 可聴、propagate 伝達、 physiology 生理学、 psychology 心理学、 infrasound 低周波



ヘルツ hertz

記号	Hz
系	国際単位系 (SI)
種類	組立単位
量	周波数・振動数
組立	s^{-1}
定義	1秒間に1回の周波数・振動数
語源	<u>ハインリヒ・ヘルツ</u>

ハインリヒ・ルドルフ・ヘルツ (Heinrich Rudolf Hertz, 1857年 - 1894年) は、ドイツの物理学者。マックスウェルの電磁気理論をさらに明確化し発展。1888年に電磁波の放射の存在を、それを生成・検出する機械構築。