



Underlying both Music and Visuals Would Be Common Factors of Sound, Light, and Solfeggio Frequencies

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Received date: 07 July 2026; **Accepted date:** 27 July 2026; **Published date:** 04 August 2026

Citation: Bando H, Tanaka N, Wago H, Bando M, Okubo T. Underlying both Music and Visuals Would Be Common Factors of Sound, Light, and Solfeggio Frequencies. *Asp Biomed Clin Case Rep.* 2026 Aug 04;9(2):141-45.

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Abstract

For integrative medicine (IM), recent topics include sound therapy, light, Solfeggio frequencies, and the visible spectrum. The 528 Hz frequency has shown a relationship with universal constants in music, light, and mathematics. The electromagnetic spectrum includes radio waves, microwaves, infrared (IR), visible light, ultraviolet (UV), X-rays, and γ -rays. Sound frequencies on the piano range from 28.5 Hz to 4186 Hz across seven octaves. At a position 40 octaves higher, the visible spectrum (380-770 nm) corresponds to the sound spectrum. Regarding gold-silver core-shell nanoparticles, optical and acoustic vibration modes have been investigated. Gold and silver correspond to 528 nm of green light and 417 nm of violet light, respectively, by surface plasmon resonance (SPR) in material science.

Keywords

Solfeggio Frequencies, Sound Therapy, Visible Spectrum, Gold-Silver Core-Shell Nanoparticles, Audio-Visual Stimulation

Commentary

Recently, the comprehension of human health, lifestyles, and society has become more important through the pursuit of truth, beauty, and goodness [1]. Such perspectives are explored in the fields of integrative medicine (IM), holistic medicine (HM), and psychosomatic medicine (PM). In these categories, music therapy and sound therapy have attracted attention because of their expected benefits for mind-body health, resilience, and human well-being. In music

therapy sessions, music playing and listening are well-known methods. In a recent report, the clinical effects of integrating Solfeggio 417 Hz frequency with dance and music therapy were observed [2]. It was a systematic review conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol, and the 417 Hz frequency intervention demonstrated moderate effect sizes for reducing depression and anxiety, while dance movement therapy revealed efficacy for depression,

anxiety, and stress. Furthermore, neural mechanisms have been clarified for musical activity through the application of novel hyperscanning technology [3]. From the obtained findings, strong relationships were found between various musical activities and inter-brain synchronization (IBS), with related responses involving the central, frontal, parietal, and temporal lobes.

For previous studies on sound therapy, high-frequency sound is known to stimulate dopamine synthesis while suppressing sympathetic nervous system activity [4]. In addition, high-frequency music can stimulate the parasympathetic nervous system, thereby reducing various stress responses. The stress-reducing efficacy of music has also been investigated for the autonomic nervous system and endocrine system [5]. Concerning the 528 Hz frequency, a variety of investigations have been reported. Recently, music with a 528 Hz frequency has gained attention as healing music. The standard tuning for the piano is usually 440 Hz for the musical note A. When multiplying 440 Hz by 1.2, the result is 528 Hz. Standard scales do not include 528 Hz in the usual tuning of the piano or keyboard. As an interesting phenomenon, changing the tuning of A from 440 Hz to 444 Hz changes the tuning of C from 523.25 Hz to 528.01 Hz. As mentioned above, music with a 528 Hz frequency is recognized as Solfeggio frequency music [6]. However, satisfactory scientific and medical evidence has not yet been established.

In modern society, medicine and science are usually categorized separately from music. Science is generally regarded as a field based on objective logic, concepts,

and principles. In contrast, music is characterized as a creative and subjective field involving fantasy, imagination, and artistic perspectives [7]. Such a dichotomous distinction may be considered ordinary. Science usually explores rationality through mathematical evidence and numerical values, whereas music expresses artistic sensibility based on impressions and feelings. Regarding the 528 Hz frequency, both sound and related light have shown relationships with universal constants in the fields of music and mathematics [8]. Thus, the 528 Hz frequency may have common roles in science, physics, mathematics, epigenetics, metaphysics, and bioacoustics, which may influence therapeutic clinical medicine and scientific research.

The electromagnetic spectrum includes radio waves, microwaves, infrared (IR), visible light, ultraviolet (UV), X-rays, and γ -rays. Visible light, the range that humans can perceive, represents only a very narrow band within this spectrum (**Fig-1**). Bees and dragonflies can perceive UV light, allowing them to locate flower nectar and pollen. Within the visible light spectrum, humans perceive colors such as red, orange, yellow, green, blue, indigo, and violet. Waves of light are extremely short. To facilitate understanding, visible light is compared using the unit angstrom ($\text{\AA}$) (**Table-1**). The colors of visible light are typically measured in thousands of angstroms. Red light with a wavelength of 680 nm ($6800 \text{\AA}$) can be calculated for its frequency (f) as follows. The speed of light is $c = 3.00 \times 10^8 \text{ m/s}$, and the wavelength is $\lambda = 680 \times 10^{-9} \text{ m}$. Therefore, $f = c/\lambda = 3.00 \times 10^8 \text{ m/s} \div 680 \times 10^{-9} \text{ m} \approx 4.41 \times 10^{14} \text{ Hz} = 441 \text{ THz}$.

Table-1: Several Types of Wavelength

Mutual Relationship Among Several Units for Length	Clinical and Actual Significance for Wavelength
1 m (meter)	
1 mm (millimeter) = 10^{-3} m	UHF: 0.1 m-1 m for ICT purpose
1 μm (micrometer) = $10^{-6} \text{ m} = 1000 \text{ nm}$	Ultra Red: 7700 $\text{\AA}$ -1 mm
10000 $\text{\AA}$ (angstrom) = $10^{-6} \text{ m} = 1 \mu\text{m}$	Red: 6400 $\text{\AA}$ -7700 $\text{\AA}$ for visible light
1000 $\text{\AA}$ (angstrom) = $10^{-7} \text{ m} = 0.1 \mu\text{m}$	Violet: 3800 $\text{\AA}$ -4300 $\text{\AA}$ for visible light
100 $\text{\AA}$ (angstrom) = $10^{-8} \text{ m} = 0.01 \mu\text{m}$	Ultra Violet: 100 $\text{\AA}$ -3800 $\text{\AA}$
1 nm (nanometer) = $10^{-9} \text{ m} = 10^{-3} \mu\text{m}$	X-ray: 1 pm-10 nm
1 $\text{\AA}$ (angstrom) = $10^{-10} \text{ m} = 10^{-1} \text{ nm}$	γ -ray: less than 10 pm
1 pm (picometer) = $10^{-12} \text{ m} = 10^{-3} \text{ nm}$	

Commentary

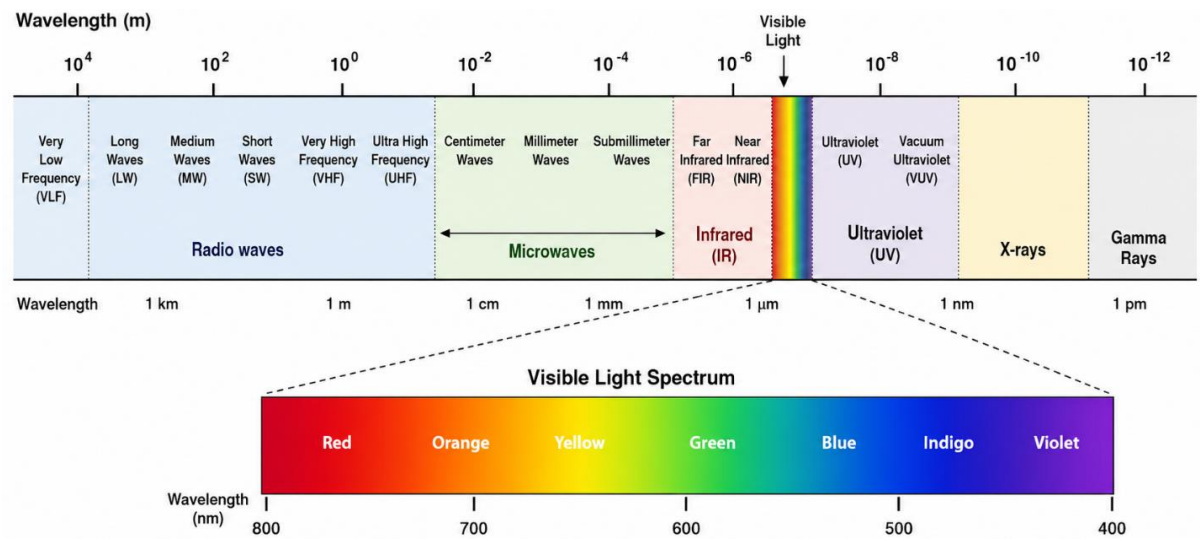


Fig-1: Electromagnetic Spectrum
Human can observe narrow spectrum of visible light

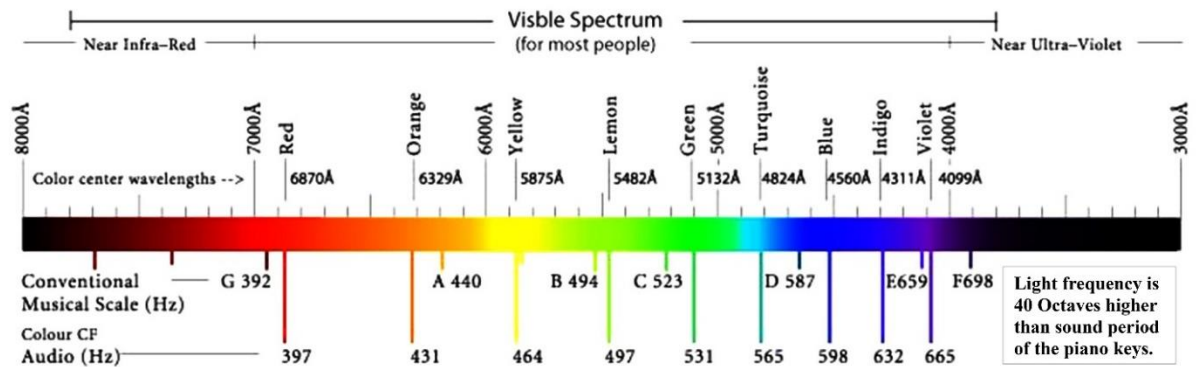


Fig-2: The measurement of Light: The wave length as the Ångstrom
This figure is revised from the original image by Fiorenza N (1997)

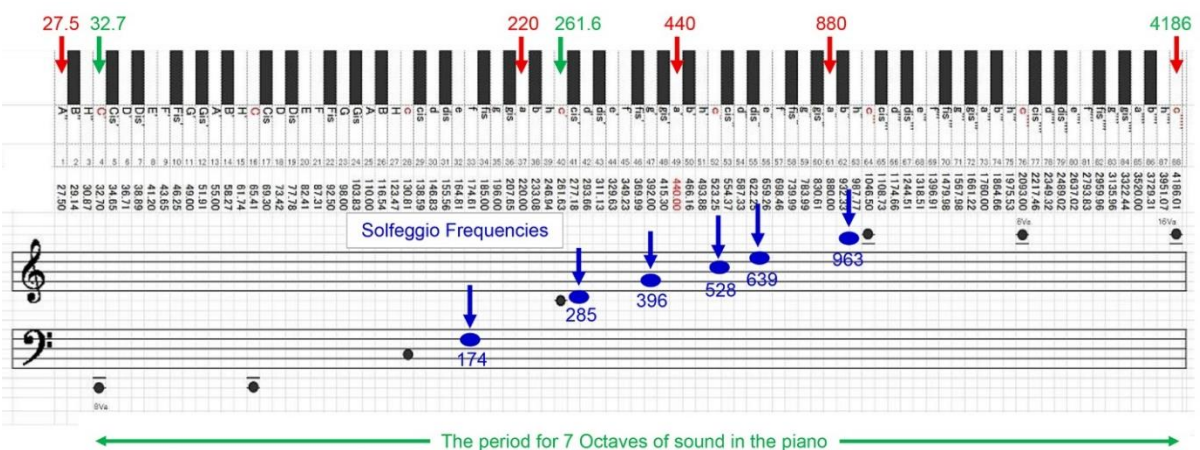


Fig-3: The relationship between light frequency and sound frequency

The symbol ($\approx$) means approximately equal to. Visible light consists of electromagnetic waves with wavelengths ranging from 380 nm to 770 nm (3800 Å-7700 Å). These wavelengths are perceptible to the human eye and appear as the colors red, orange, yellow, green, blue, indigo, and violet, generally recognized as seven colors in decreasing wavelength order. The relationship between visible light wavelengths and

colors is summarized in **Table-2**, where nine colors are included.

Table-2: Color and Frequency

Visible Color	Wavelength (Å)
Red	6870 Å
Orange	6329 Å
Yellow	5875 Å
Lemon	5482 Å
Green	5132 Å
Truquoise	4824 Å
Blue	4560 Å
Indigo	4311 Å
Violet	4099 Å

The octave of visible light is 40 octaves above the middle audio-active range and 46 octaves above the alpha brain wave octave (not shown) (**Fig-2**). However, light is measured by wavelength, whereas sound is measured by frequency. Frequency is a measure of how many waves occur within a given period of time, and the common unit is the hertz (Hz). If middle C (523.25 Hz) is raised by 40 octaves, the resulting frequency would be approximately 581 million hertz. Instead of frequency, light is generally measured by wavelength. The relationship is expressed as $\lambda = c/f$, where λ is wavelength, f is frequency, and c is the speed of light at the Earth's surface, approximately 299,727,738 m/s ($\approx 300,000$ km/s).

In recent years, a close relationship has been reported between sound frequencies known as Solfeggio frequencies and electromagnetic wave frequencies, such as those of light and radio waves [8]. To facilitate understanding, the 88 keys of a piano are used here [9] (**Fig-3**). C (261.6 Hz) and A (440 Hz) are located near the center, and the frequency doubles with each octave. The lowest note is A (27.5 Hz), and the highest note is C (4186 Hz). Additionally, the six major Solfeggio frequencies are indicated. A piano keyboard spans seven octaves, and the range 40 octaves higher corresponds to the range of light frequencies shown in **Fig-2**.

Regarding gold-silver core-shell nanoparticles, optical and acoustic vibration modes have been investigated. Upon exposure to sound or light, conduction electrons oscillate collectively in response to

The electric field [10]. The wavelength is typically within the UV-visible range (390-550 nm, 3900-5500 Å). This range includes green light (528 nm) and violet light (417 nm), both of which correspond to Solfeggio frequencies. Furthermore, the 396 Hz frequency is within this period, and the pure 396 Hz tone is consistent with the DOE note, representing the first three tones in the musical scale: DOE, RE, and MI [11]. Recent developments in material science have demonstrated, through surface plasmon resonance (SPR), that pure silver broadcasts "RE" at the 417 Hz frequency in sound and at 417 nm of violet light from its surface [12]. The results of this experiment were quantified in the electromagnetic color spectrum [10]. In a similar study, pure gold exhibited SPR at 528 nm of green light [13].

Some evidence has been reported regarding the function of the green color at 528 nm. These include: i) the primary energy utilized by chlorophyll to produce antioxidant, life-giving, free radical-scavenging oxygen [11]; ii) remarkable therapeutic applications in the medical treatment of various illnesses [14]; and iii) quantum dynamics that can cymatically influence molecular structuring central to biology, organic chemistry, and genetic expression [11]. The authors and co-researchers have continued research on sound therapy, music therapy, and Solfeggio frequencies [9]. Their work has combined research in acoustics, musicology, and audio-visual stimulation using appropriate music and video [15]. Through research on the frequencies of 174 Hz, 396 Hz, 528 Hz, 639 Hz, and 963 Hz, each frequency has demonstrated certain clinical roles in human psychological health, contributing to wellness and well-being [16].

In summary, the authors have continued various studies on music therapy and sound therapy, in which Solfeggio frequencies have recently been included. Consequently, meaningful relationships among sound, music, mathematics, medicine, and well-being may be further clarified. The current article is expected to become a useful reference for the future development of research, health care, and medical treatment.

Conflict of Interest

The authors have read and approved the final version

of the manuscript. The authors declare no conflicts of interest.

Funding

There was no funding received for this study.

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