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Locating Schumann Resonant Frequencies on a Single Particle Radiation Patterns Using Golden Ratio Spiral and Octave Relationship of Schumann Points.

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Although lightning discharge is not the only source or only physical phenomenon that affects the Schumann resonances, they have the highest contribution to the Schumann resonances oscillating between the ground the ionosphere. Schumann resonances are predicted through several different numerical models such as the transmission-line matrix model or partially uniform knee model. This contribution reports a different prediction method for Schumann resonances derived from the first principle of fundamental physics combining both particle radiation patterns and the mathematical concept of the Golden ratio. This prediction allows the physical understanding of where Schumann resonances originate from radiation emitted by a particle that involves many frequencies that are not related to Schumann resonances. In addition, this method allows predicting the wave propagation direction of each frequency value in the Schumann frequency spectrum. Particles accelerated by lightning leader tip electric fields are capable of contributing most of the Schumann resonances. The radiation pattern of a single particle consists of many frequencies. There are only specific ones within this pattern that contribute to the Schumann radiation. The vast majority of Schumann resonances distribute quite nicely obeying the Golden ratio interval. This property, used in conjunction with the full single-particle radiation patterns, also revealed that high-frequency forward-backward peaking radiation patterns, as well as low-frequency radiation patterns, can contribute to Schumann resonances. This method allows to locate them on the full radiation pattern. A theoretical analysis using the Golden ratio spiral, predict that there are more Schumann resonances in the high-frequency forward-backward peaking radiation pattern of a relativistic particle than low-frequency dipole radiation pattern. Extending the idea to an octave that identifies the identical sounding notes with different frequencies in standing waves. By knowing the value of the initial Schumann resonant frequency, this method allows us to predict the magnitude of other Schumann resonances on the radiation pattern of a single accelerated charged particle conveniently. In addition, it also allows us to find and match Schumann resonances that are on the same radiation lobe, which is named electromagnetic Schumann octaves. Furthermore, it is important to find Schumann octaves as they propagate in the same direction and have a higher likelihood of wave interference.