Spatial and Temporal coherence

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Spatial coherence is a concept of wave disturbance describing the correlation between periodic transmitted energy (wave signals) from one point to another. It can also be said that it is a mutual interdependence or connection of variable wave quantities of two different points in a given instant of time. The coherence is presented as a function of distance and mapped as correlation against an absolute distance between points in question.

While spatial coherence is concerned with the phase correlation of waves in different observation points, temporal coherence entails the phase correlation of waves at a given point in space at two different instances of time. It is the measure of the average correlation between the value of a wave and itself delayed by a certain period of time depicting the characteristics of how well a wave can create an interference with itself. The delay on which the correlation effect is emphatically low is denoted by the degree of $\tau_c$ (coherence time)\[^3\], a state at which there is a significant shift in amplitude.

Michelson–Morley experiment

Showing Temporal Coherence

When one of the mirrors is moved away gradually, the time for the beam to travel increases and the infringes become dull and finally are lost.

Young's interference experiment

----Showing spatial coherence

If the space between the two slits is increased, the coherence dies gradually and finally the infringes disappear.

Ø References

1. Interference and coherence definitions [Online source]

2. Interference and Coherence applet [Online source]
   Url: http://serc.carleton.edu/NAGTWorkshops/deepearth/activities/40826.html

3. Temporal and spatial coherence definitions [Online source]

4. Interference description [Online source]
   Url: http://www.physicsclassroom.com/class/waves/u10l3c.cfm