Theory of Objective Motions of Wave Source and Receiver in Medium Body

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1 Wave Sources and Receivers

Objects transmitting wave signals are wave sources, such as the sound sources of trains and the light sources of celestial bodies. People or objects receiving wave signals are receivers, such as the men listening to the sounds of trains and the telescopes in the outer space recording light signals from stars and galaxies. When we observe, we receive light signals from the light sources. All celestial bodies are wave sources and we are receivers of their wave signals.

2 Medium Bodies and Perfect Vacuum

Except perfect vacuum, which only exists in theory, not in reality, lights transmit through medium, which consists of particles. When due to some external limitation, some particles are contained in a certain space, they form a material medium body. The external limitation can be a closed shell. For example, the shell of a train contains all the air in the train and forms the train's air medium body. The external limitation can also be a shapeless force. For example, the gravity of the earth limits the air around the earth and forms the earth's air medium body.

If a container is in a state of perfect vacuum, it makes a (perfect) vacuum medium body. There is no particle in a (perfect) vacuum medium body and it is a nonmaterial medium body.

Both material medium body and nonmaterial vacuum medium body are medium bodies.

3 Internal Independence and External Dependence of Medium Bodies

A small medium body may move in a large medium body. The large medium body is called the small medium body's mother medium body, and the small medium body is called the large medium body's son medium body. For example, the earth's air medium body is the train's air medium body's mother medium body, and the train's air medium body is the earth's air medium body's son medium body.

When receivers in a son medium body observe and measure wave sources in the son medium body, it is unnecessary to consider, and it is impossible to measure, the velocity of the son medium body in the mother medium body. This attribute of medium bodies is called the internal independence of medium bodies. Because of this attribute of internal independence，it is impossible to measure the velocity of a train in the earth's air medium body with sound, light, or electromagnetic wave experiments. It is also impossible to measure the velocity of the earth in the solar system with light or electromagnetic wave experiments. That is why Michelson-Morley experiment fails to detect the speed of earth moving around the sun.

When receivers in a son medium body observe and measure wave sources in its mother medium body, or when receivers in a mother medium body observe and measure wave sources in its son medium body, it is necessary to consider, and it is possible to measure, the velocity of the son medium body in the mother medium body. This attribute of medium bodies is called the external dependence of medium bodies. When we, the observers of the universe, receive light or electromagnetic wave signals from celestial bodies, and observe planets in the solar system, stars in the Milky Way, and galaxies outside the Milky Way, we must consider our motions as receivers

in the solar system, in the Milky Way, and in the universe, as the solar system, the Milky Way, and the universe are all material medium bodies.

4 Objective Durations and Subjective Durations of Wave Signals

Wave signals without durations, such as the light signal in Einstein's first paper of the theory of relativity, *On the Electrodynamics of Moving Bodies*, is unanalyzable and without value of analysis and measurement in physics. Period, frequency, and wavelength are all concepts based on the concept of duration. We use two observers' different judges of a wave signal in a model of two trains to analyze quantitatively the Doppler effect of wave in a medium body and take the earth's air medium body as an example.

Let us assume a train S moves forward with speed V_S in the earth's air medium body and there is an observer Sally in S. In front of S, another train R, moves forward with speed V_R and there is an observer Robert in R. The speed of the wave in the earth's air medium body is V. At the moment of t_{S0}, the front of a wave signal leaves S, and at this moment, the distance between R and S is d_{SR0}. The front of the wave signal arrives at R at the moment of t_{R0}. When the front of the wave signal propagates forward, R is moving forward too, so $V(t_{R0}-t_{S0})=d_{SR0}+V_R(t_{R0}-t_{S0})$ and $t_{R0}=d_{SR0}/(V-V_R)+t_{S0}$. The end of the wave signal leaves S at the moment of $t_{S1}=t_{S0}+\tau_S$, and the distance between R and S at this moment is $d_{SR1}=d_{SR0}+V_R\tau_S-V_S\tau_S$. The end of the wave signal arrives at R at the moment of t_{R1}, so $V(t_{R1}-t_{S1})=d_{SR1}+V_R(t_{R1}-t_{S1})$ and $t_{R1}=d_{SR1}/(V-V_R)+t_{S1}$. In Sally' s measurement, the signal starts at t_{S0} and ends at t_{S1}, so Sally judges that the signal has duration of $\tau_S=t_{S1}-t_{S0}$. In Robert's measurement, the signal starts at t_{R0} and ends at t_{R1}, so Robert judges that the signal has duration of $\tau_{RseeS}=t_{R1}-t_{R0}=\tau_S(V-V_S)/(V-V_R)$.

The duration of a wave signal measured by the observer moving with the wave source is defined as the objective duration of the wave signal. The duration of a wave signal measured by the observer not moving with the wave source is defined as the subjective duration of the wave signal.

5 Objective Characteristics and Subjective Characteristics of Wave Signals

Now assume the objective duration of the wave signal, τ_S, equals one objective period of the wave signal, T_S, so we have $\tau_S=T_S=1/f_S$ and $\lambda_S=V/f_S$, with f_S and λ_S as the objective frequency and the objective wavelength of the wave signal.

The wave signal with one period cannot change to a wave signal with several periods, so in the measurement of receiver R, the wave signal still has one period, the subjective period, $T_{RseeS}=T_S(V-V_S)/(V-V_R)$.

The ratio of the subjective period and the objective period is defined as y, so $y=(V-V_S)/(V-V_R)$.

So, because of the motions of the wave source and the receiver, the subjective characteristics of the wave signal are: $\tau_{RseeS}=\tau_S y$, $T_{RseeS}=T_S y$, $f_{RseeS}=f_S/y$, and $\lambda_{RseeS}=\lambda_S y$.

Analysis above is suitable for sound signal when V is the speed of sound in the air. Analysis above is suitable for light signal and electromagnetic wave signal too when V is the speed of light in the air.

6 Theory of Objective Motions of Wave Source and Receiver in Medium Body

It is traditionally regarded that there must be a reference body (frame) to measure a body's velocity. But, in a medium body, the velocity of wave propagated from the wave source to the receiver, ***V***, can and should be the standard of measurement for the velocities of the wave source and the receiver. So, in the measurement of the motions of wave sources and the receivers, the reference body is not needed. For convenience, in material medium body, the material medium

can be regarded as the reference body.

The velocities of the wave source and the receiver in a medium body, $\boldsymbol{V}_S$ and $\boldsymbol{V}_R$, measured using the velocity of wave propagated from the wave source to the receiver $\boldsymbol{V}$ as the standard of measurement, are defined as their objective velocities in the medium body.

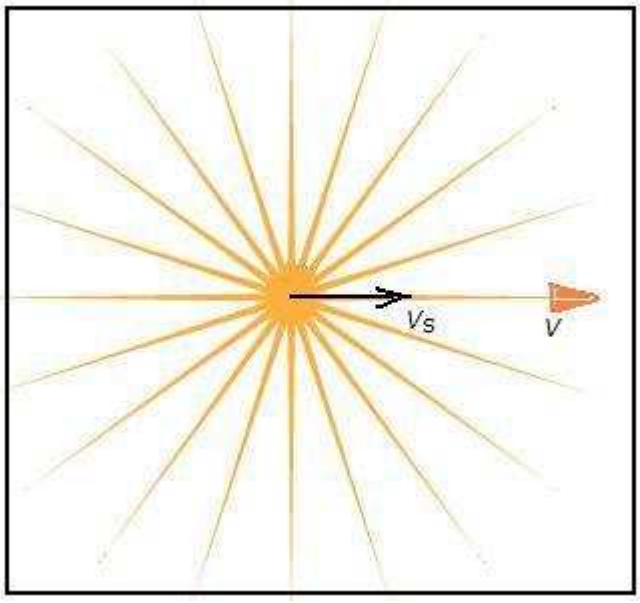

Figure 1: A Light Source Moving Objectively

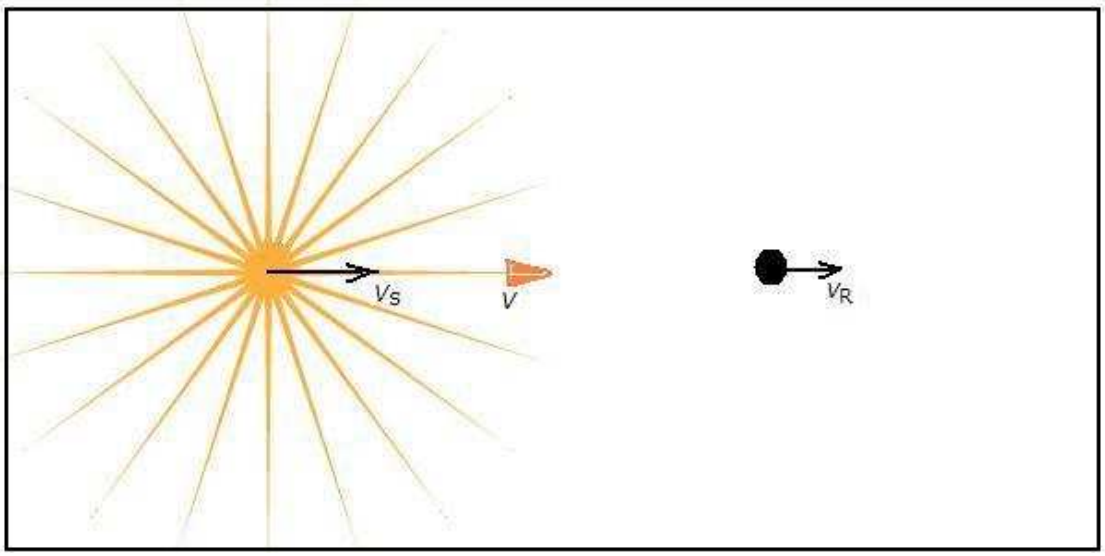

Figure 2: A Light Source and a Receiver Moving Objectively

When the directions of $\boldsymbol{V}_S$ and $\boldsymbol{V}_R$ are in the same line with the direction of $\boldsymbol{V}$, $y=(\boldsymbol{V}-\boldsymbol{V}_S)/(\boldsymbol{V}-\boldsymbol{V}_R)$. When the directions of $\boldsymbol{V}_S$ and $\boldsymbol{V}_R$ are not in the same line with the direction of $\boldsymbol{V}$, $y=(V-V_S\cos\alpha_S)/(V-V_R\cos\alpha_R)$, where α_S is the angle between the vector $\boldsymbol{V}_S$ and $\boldsymbol{V}$ and α_R is the angle between the vector $\boldsymbol{V}_R$ and $\boldsymbol{V}$.

The theory considering the objective motions of the wave source and the receiver in medium body is called the theory of objective motions.

7 Shell Method of Velocity Measurement

A son medium body with a shell can measure its own velocity in its mother medium body without any reference body. Take a train as an example and assume the train move forward with

speed V_T. Set a wave source S and a receiver R on the top of the train outside the shell, with the wave source behind the receiver with distance d_{SR0}. The front of a wave signal leaves S at the moment with speed V and arrives at R at the moment of t_{R0}, so $V(t_{R0}-t_{S0})=d_{SR0}+V_R(t_{R0}-t_{S0})$ and $V_T=V-d_{SR0}/(t_{R0}-t_{S0})$. In this way, the velocity of the son medium body in its mother medium body can be measured or verified.

8 Precise Radar Velocity Measurement

The airborne radar S transmits an electromagnetic wave signal with frequency f_S to the target plane R. The target plane R reflects the signal. When the airborne radar S received the signal, the received frequency is $f_{SseeR}=f_S[(V-V_R\cos\alpha_R)(V+V_S\cos\alpha_S)]/[(V-V_S\cos\alpha_S)(V+V_R\cos\alpha_R)]$. Let $r=f_{SseeR}/f_S$, then the speed of the target plane can be calculated by

$V_R=[(1-r)V^2+(1+r)VV_S\cos\alpha_S)]/\{[(1+r)V+(1-r)V_S\cos\alpha_S)]\cos\alpha_R\}$

If the radar is ground-based, then $f_{SseeR}=f_S(V-V_R\cos\alpha_R)/(V+V_R\cos\alpha_R)$, so the speed of the target plane can be calculated by

$V_R=(1-r)V/[(1+r)\cos\alpha_R]$

9 Celestial Medium Bodies

Celestial medium Bodies are formed because of the gravity of the celestial bodies. The earth medium body includes the earth's air medium body, but it includes more. All the particles moving around the earth are in the earth medium body, regardless of their density, so the earth medium body goes as far as the moon, as the moon moves around the earth too. It does not look like a ball, but looks like a comet, as the medium is pushed by the solar wind.

The solar medium body is formed because of the gravity of the sun and it includes all the particles moving around the sun in the solar system. It starts from the surface of the sun and goes beyond Oort Cloud. All planets move around the sun near a plate. So are the particles. So the solar medium body does not look like a ball, but looks like an ellipsoid. The solar medium body is the mother medium body of the earth medium body.

The Milky Way medium body is formed because of the gravity of the Milky Way and it includes all the particles moving around the Milky Way. Like the solar medium body, it looks like an ellipsoid, but is much larger. The Milky Way medium body is the (level-1) mother medium body of the solar medium body, and the level-2 mother medium body of the earth medium body,

The universe medium body is the largest medium body. But is it the level-1 mother medium body of the Milky Way medium body, and the level-2 mother medium body of the solar medium body, and the level-3 mother medium body of the earth medium body? Up to now, we are not sure.

10 Reasons of the Redshift

The earth moves in the solar medium body with velocity $\boldsymbol{V}_{Earth}$, and a wave source moves in the solar medium body with velocity $\boldsymbol{V}_S$, so in the observation, we have $y_1=(V_1-V_S\cos\alpha_S)/(V_1-V_{Earth}\cos\alpha_{Earth})$, where V_1 is the speed of the wave in the solar medium body.

The solar system moves in the Milky Way medium body with velocity $\boldsymbol{V}_{SolarSystem}$, and a wave source moves in the Milky Way medium body with velocity $\boldsymbol{V}_S$, so in the observation, $y_2=(V_2-V_S\cos\alpha_S)/(V_2-V_{SolarSystem}\cos\alpha_{SolarSystem})$, where V_2 is the speed of the wave in the Milky Way medium body.

At the moment, let us assume the universe medium body is the mother medium body of the Milky Way medium body, and the Milky Way medium body moves in universe medium body with velocity $\boldsymbol{V}_{MilkyWay}$, and a wave source moves in the universe medium body with velocity $\boldsymbol{V}_S$, so in

the observation, $y_3=(V_3-V_S\cos\alpha_S)/(V_3-V_{MilkyWay}\cos\alpha_{MilkyWay})$, where V_3 is the speed of the wave in the universe medium body.

So the redshift of the planets is from y_1, the redshift of the stars is mostly from y_2, and the redshift of the galaxies and quasars is mostly from y_3. The reasons of the high redshift of some quasars are the velocity of the Milky Way medium body in the universe medium body and the velocities of the quasars in the universe medium body, not the relative speed of the quasars leaving us.

11 Edge Convex Lens Characteristics of Celestial Medium Bodies

The density of the medium of a celestial medium body is not consistent. The nearer to the central celestial body, the denser the medium becomes. The farther from the central celestial body, the thinner the medium becomes. When a celestial medium body exists between the wave source and the receiver, the wave has to travel past the medium in this celestial medium body and refracts. It looks like an edge convex lens existing between the wave source and the receiver. All phenomenon explained by gravitational lens can be explained with the edge convex lens characteristics of celestial medium bodies. When light from a star goes near the sun, it refracts because of the dense medium existing around the sun, not because of the gravity of the sun.

12 Space and Time

Another name of medium body, is medium space, or space. There is no perfect vacuum space in the universe. Medium consisting of particles always exists between the wave source and the receiver. The theory of relativity, based on the concept of perfect vacuum, is wrong and meaningless in physics.

Time is absolute and objective. Distance between the wave source and the receiver, and motions of the wave source and the receiver, cannot change time. The problem of simultaneity is caused by distance between the wave source and the receiver, not by motions of the wave source and the receiver as it is explained in the theory of relativity. The problem of duration is caused by motions of the wave source and the receiver, and the difference between the objective duration and subjective duration should be made clear using the theory of objective motions of the wave source and receiver in medium body.

Space and time are independent of each other, and they are not relevant. The word spacetime is meaningless in science.