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A New Equation of Light Trajectory

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Abstract: The article shows that the essential equation of light trajectory is very simple and that is connected with the third derivative of the coordinate oppositely than the classic mechanics where the second derivative is the last significant one.
Keywords: light, trajectory, deflection.

Introduction

Light movement can be well described only by its wave nature and formula for the refraction of light between two media. The article shows that every localized carrier of the light has trajectory described with the equation (9). The solution of equation (9) is especially interesting when *v* is constant.

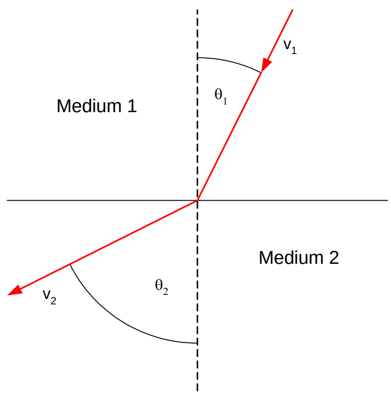
Derivation

Let start from the well-known equation of light refraction:

$$\frac{\mathrm{SIN}(\theta_1)}{\mathrm{SIN}(\theta_2)} = \frac{v_1}{v_2} \tag{1}$$

Whereas:

v_1 = the speed of light in medium 1,
v_2 = the speed of light in medium 2,
θ_1 = angle of light's deflection in medium 1,
θ_2 = angle of light's deflection in medium 2.

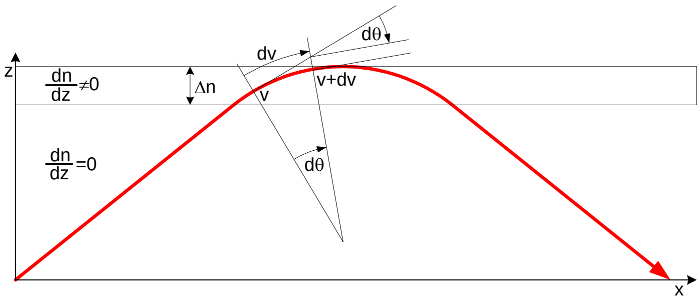


We can suppose that the mediums are nearly equals and that the light speeds are also nearly equals, than we have:

$$\frac{\mathrm{SIN}(\theta + d\theta)}{\mathrm{SIN}(\theta)} = \frac{v + dv}{v} \tag{2}$$

$\Rightarrow$

$$\frac{\mathrm{SIN}(\theta)\cdot \mathrm{COS}(d\theta) + \mathrm{COS}(\theta)\cdot \mathrm{SIN}(d\theta)}{\mathrm{SIN}(\theta)} = 1 + \frac{dv}{v} \tag{3}$$



It can be derived directly:

$$\frac{\mathrm{COS}(\theta)}{\mathrm{SIN}(\theta)}\cdot d\theta = \frac{dv}{v} \tag{4}$$

$\Rightarrow$

$$\frac{\mathrm{COS}(\theta)}{\mathrm{SIN}(\theta)} = \frac{1}{v}\cdot\frac{dv}{d\theta} \tag{5}$$

$\Rightarrow$

$$\mathrm{TAN}(\theta) = \frac{v}{\left(\frac{dv}{d\theta}\right)} \tag{6}$$

$\Rightarrow$

$$\theta = \mathrm{ATAN}\left(\frac{v}{\left(\frac{dv}{d\theta}\right)}\right) \tag{7}$$

After the both sides of equation are differentiated by θ, hence the following formula is obtained:

$$v\cdot\frac{d^2v}{d\theta^2} + v^2 = 0 \tag{8}$$

Finally:

$$\boxed{v + \frac{d^2 v}{d\theta^2} = 0} \tag{9}$$

I.e.

$$|\vec{v}| + \frac{d^2|\vec{v}|}{d\theta^2} = 0 \tag{10}$$

This is the final equation of the light trajectory, which gives the basic relation between the path of the light beam and its differential declination. Evaluated equation for E^3 space is given by the following equation:

$$\vec{v}^2 \cdot \left(\vec{a} \times \dot{\vec{a}}\right) = 2 \cdot \vec{a}^2 \cdot \left(\vec{v} \times \vec{a}\right) \tag{11}$$

Conclusion

This is the final light beam trajectory equation. It shows that there is a great influence of the third time derivation of the coordinates, while in classic mechanics the second derivative is the last significant one. It also shows that light changes its speed near the rigid bodies' edges and in gaps too. The equation could be used for testing purposes in new electromagnetic theories.

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