Some Interesting Calculations of Physical Quantities of Ideal Gas of Photons

This article gives calculation of the mass of a photon and an expression for the wavelength of a photon.

The entropy of an ideal gas of photons is calculated as follows:

dE=dQ-dW

For an ideal gas at constant temperature we have:

dE=CvdT=TdS-PdV

At constant temperature one has:

CvdT=0

Therefore one gets the following mathematical expression:

TdS=PdV

This then gives:

dS=PdV/T

Using the ideal gas law PV=nRT and isolating P/T one gets:

P/T=nR/V

Substituting this expression in the above equation for S one gets:

dS=(nR/V)*dV

Integration of both sides gives:

S=nR*ln(V)

We know also that:

F1*L=nRT*ln(V)

This equation is obtained by comparing the work that is done by the force F1 with the volume expansion work of an ideal gas.

Thus one obtains the following expression:

F1*L=nR*ln(V)=S

Therefore:

S=F1*L/T

In this article it will be shown how to associate a mass m with a photon in the new picture of force equation that was presented in an earlier article and which has the following mathematical form:

F=F1*(c/v)

This equation was derived in a separate article and has the physical significance of changing the velocity of light as a

function of the applied force. By changing the force F the velocity of light v will also change inversely proportional to the applied force F.

It will be shown now that a hypothetical mass m can be associated with the photon based on this new equation. This can be done by substituting the value m(dv/dt) for the force F in the above equation and by solving for the mass m by isolating it.

M(dv/dt)=F1*(c/v)

Multiplying by v and dt one gets the following mathematical expression:

Mdv*v=F1*c*dt

By integrating both sides on v and t one gets the following mathematical expression:

M*(v2)/2=F1*ct**

Ct is nothing but the distance covered by the light in time t. This distance will be denoted L. Thus:

M*(v2)/2=F1*L**

This very interesting mathematical relation relates the kinetic energy of the photon that is associated with the force F to

the work done by the force F1 along the distance L.

The mass of the photon can be obtained from this expression by isolating the value of m.

By doing so we get the following expression for the mass m:

M=2*F1*L/(v2)**

This expression of the mass needs to be verified experimentally.

By equating the kinetic energy of the photon with the thermal energy of an ideal gas which has the following value of (3/2)*(K*T) one can relate the velocity of the photon v to the temperature T. By doing so one gets the following mathematical expression:

M*(v2)/2=(3/2)K*T**

We see from this mathematical expression that the square of the velocity of light v is proportional to the temperature of the photon T.

The interaction between light and matter is the basis of the subject of spectroscopy which is traditionally considered a branch of physical chemistry but also is considered part of the physical science. The manner of interaction can be either through the absorption of electromagnetic wave or through the emission of photons at various wavelengths and frequencies. The electromagnetic entity that interacts with the matter is manifested as a photon of light that has the following equation:

E=h*(ni)=hc/lambda

Where E stands for the energy of the photon and ni is its frequency. Also lambda stands for the wavelength that is associated with the photon.

This equation was used traditionally to solve problems that involve electromagnetic radiation. An example is its use to explain the photoelectric effect of Einestein and its use to explain the Compton effect. These two experiments were pivotal for the manifestations of light as an entity that behaves like a particle. Light was shown to exhibit both wave as well as matter properties. The wave properties of light were elucidated using diffraction and interference experiments.

The two experiments by Compton and Einstein photoelectric effect relied on the energy equation of a photon which can be shown to be invalid in the description of photons using equations that relate the forces acting on the photon to its velocity v. The energy equation of a photon can be shown to be invalid by converting it into an equation that relates the force on the photon to its wavelength as follows from this equation:

E=hc/lambda

By differentiating the equation according to r (the displacement) one converts the energy expression of the photon into a force acting on the photon as follows:

(dE/dr)= -hc/{(lambda)2}**

F= -hc/{(lambda)2}**

Isolating the value of lambda one gets the following expression for lambda:

Lambda=i*SQRT(hc/F)

This expression shows that in the picture of the force acting on the photon one gets a complex imaginary value of the wavelength lambda. This value obviously has no physical significance. Thus, the equation that gives the picture of the force acting on the photon gives the result that the expression:

E=hc/lambda is not correct and should not be used as a reference for calculations of parameters that involve photon systems.

Therefore in order to be able to calculate parameters that are related to the wavelength of the photon other

mathematical expression should be used. This equation has yet to be discovered if the photon can really be depicted using a wave and a frequency as postulated and supported experimentally by the experiments of light diffraction and light interference.

The particle nature of the photon was shown in the equation that relates the forces that act on the photon to its velocity. One of the consequences of this equation is the association of a hypothetical mass with the individual particle of photon.

According to the newly developed equation that relates the forces acting on the photon to its velocity the speed of light is a variable entity so that its equation of motion must be taken into consideration when solving the Schroedinger equation for interacting light with a particle. Also the perturbation of the time dependent Hamiltonian of the discussed system must include the time dependence of the light propagation with time.

In addition, the propagation of the magnetic and electric fields that are associated with the light beam is not at a constant velocity anymore but is at a variable velocity that depends on the forces acting on the photon. Thus Maxwell equations need to be modified to account for a variable speed of light.

next i will give an expaination about the controversial nature of the energy of the photon:

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