**Force of Cherenkov radiation**

Manjunath. R. (Reader in physics)

#16, 8th Main road

Shivanagar, Rajajinagar

Bangalore-560010

Karnataka, India

**manjunathr1988@yahoo.in**

**Abstract** : The new mathematical model allows us to calculate force of Cherenkov radiation . It is shown that the equation for the calculation of force of Cherenkov radiation radiationaccounts for Angular frequency of electromagnetic radiation and refractive index of the medium .The energy of Cherenkov radiation is defined as a function offorce exerted by electromagnetic radiation (Cherenkov radiation ) and refractive index of the medium .The above expressions was developed based on the basic concepts of electromagnetic radiation ,quantum mechanical concepts and mathematical concepts.

**Key words :** Force of Cherenkov radiation , Speed of light , Frequency of electromagnetic radiation, Wavelength of Cherenkov radiation, velocity of electromagnetic radiation..............

Cherenkov radiation is the [electromagnetic radiation](http://en.wikipedia.org/wiki/Electromagnetic_radiation) emitted when a [charged](http://en.wikipedia.org/wiki/Electric_charge) [particle](http://en.wikipedia.org/wiki/Particle_physics) (such as an [electron](http://en.wikipedia.org/wiki/Electron)) passes through an [insulator](http://en.wikipedia.org/wiki/Electrical_insulation) at a constant [speed](http://en.wikipedia.org/wiki/Speed) greater than the [speed of light](http://en.wikipedia.org/wiki/Speed_of_light) in that medium . Light produced by charged particles when they pass through an optically transparent medium at speeds greater than the speed of light in that medium. For example, when [electrons](http://www.answers.com/topic/electron) from a nuclear reactor travel through shielding water, they do so at a speed greater than that of light through water and they displace some electrons from the atoms in their path. This causes emission of [electromagnetic radiation](http://www.answers.com/topic/electromagnetic-radiation) that appears as a weak bluish-white glow.



Figure-1: Emission of Cherenkov radiation

Force exerted by electromagnetic radiation (Cherenkov radiation ) is given by

**Fem = Eem / λem** ..........(1)

Here **Fem =** Force exerted by electromagnetic radiation (Cherenkov radiation), **Eem=**Energy of Cherenkov radiation , **λem=** Wavelength of Cherenkov radiation .

According to Max planck’s law of radiation

Energy associated with theelectromagnetic radiation (Cherenkov radiation) is given by

**Eem =h*f*em** ...................(2)

Here **h**=Plancks constant(6.625\*10-34Js) , ***f*em=**Frequency of electromagnetic radiation **.**

Thus (1)becomes **Fem = h*f*em / λem** ...........(3)

Frequency of electromagnetic radiation is given by

***f*em=*V*em/** **λem**

Here ***V*em=** velocity of electromagnetic radiation , **λem=** Wavelength of Cherenkov radiation.

**λem** = ***V*em/ *f*em**.............(4)



Figure-2:The characteristic blue glow of [nuclear reactors](http://en.wikipedia.org/wiki/Nuclear_reactor) is due to Cherenkov radiation.

Thus(3)becomes **Fem *V*em = h*f*em 2**.................(5)

***n*** is the refractive index of the medium and so the emitted electromagnetic radition travel at speed

***V*em=C/*n*** ................(6)

Here **C** = Speed of light in vaccum(3\*108m/s)

Thus (5)becomes

**Fem C/*n*  = h*f*em 2**.............(7)

Let us multiply the equation(7) by4**π2**

4**π2Fem  = (**4**π2 h*f*em 2) *n* / C** .....................(8)

Angular frequency of electromagnetic radiation is given by

***ωem =2* π*f*em**....................................(9)

Thus the equation (8) becomes **Fem= h *ωem*2 *n* /**4**π2 C** ..........................(10)

Let ***k*** = **h/4π2 C**

Here ***k=***proportionality constant

**Fem= *k ωem*2 *n*** .........................(11)

Here ***ωem*** =Angular frequency of electromagnetic radiation ,***k =*** proportionality constant ,***n***=Refractive index of the medium , **Fem=** Force exerted by electromagnetic radiation (Cherenkov radiation ).

Energy of electromagnetic radiation is given by

**Eem =h *ωem* /2π**..................(12)

***ωem*2=4π2** **Eem2/h**................(13)

Thus the equation (11) becomes **Fem= *k*4π2** ***n* Eem2/h**.......................(14)

Let ***k1*** = ***k*4π2/h**

Here ***k1 =*** proportionality constant .

**Fem=**  ***k1 n* Eem2**..........................(15)

**Eem= (Fem/** ***k1 n )1/2***....................(16)

Here, ***k1 =*** proportionality constant, **Eem** =Energy of electromagnetic radiation, **Fem=** Force exerted by electromagnetic radiation (Cherenkov radiation ), ***n*** is the refractive index of the medium