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Electron-Positron Plasma Considerations in Nano-Femto Second Time Range

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ABSTRACT: The electron-positron plasmas are not limited to just laboratories they can be found in many different places from filament of a lamp or stellar phenomena So knowing electron-positron plasmas play a crucial role in understanding the world that we live in. Ionization of gases and formation of plasma and even the X radiation of massive masses in the sky can be studied using the principles of electron-positron plasmas. Here we analyze the properties of electron-positron plasma from nanosecond to fem to second, properties such as temperature, frequency, energy etc.

Keywords: Electron Positron plasma, Electromagnetic Wave, radiation.

INTRODUCTION

Electron-positron plasma

It is true that most part of the stellar construction constituted from electron-positron plasma .Preparation of this special plasma is possible only with the confinement of ionized gas which led to electron production while from other devices like Ring Storage one could add caught positrons into the electron vessel (Wikipedia.org).

MATERIALS AND METHODS

Time consideration of electron-positron plasma

After electron-positron plasma preparation one could proceed as:
1-It may happen that the pair could produce a bound and keep aside in an or bitalicgas (Chen, 1984).
2-With inducing an energy amount about gamma ray, one electron keep field conversion and transform into a positron (Chen, 1984).
3-If positron magnetic poles transform into prior electron magnetic pole, then electron-positron repel each other magnetically so as they get away from each other yet out of their common orbital (Chen,1984).
4-Electron-positron in their plasma form keeps in a phase quadrant of each other (Chen, 1984).
5-Electron-positron in their plasma make attractive interaction produce a new bound while give up a part of (Chen, 1984).
6-Positrons conversion takedown and transform into an electron (Chen, 1984).
7-Electron-positron pair repel each other while give back their energy amount (Chen, 1984).
8-Electron-positron pair keep 270° phase quadrant (Chen, 1984).
9-Electron-positron pair attracts each other again, produce a new bound and give back a fraction of their energy, transform the floating shape in the gas or keep move less (Chen, 1984).
In this research we consider these variations in the time about nanosecond-fem to second range.
Because of quantum governing level of these plasmas we used Heisenberg Uncertainty Principle (Chen, 1984) first in the time ranges mentioned above:

$\Delta E \Delta T \geq h$(1)

$\Delta E \geq \frac{h}{\Delta T}$

$h=6.63*10^{-34}$j.s

For our research we use the time ranges as bellow respectively:

$\Delta T=10^{-15}s$ ، $10^{-14}s$ ، $10^{-13}s$ ، $10^{-12}s$ ، $10^{-11}s$, $10^{-10}s$ ، $10^{-9}s$.

At this level our particles are not, relativistic but instead they are in the classical level,
So:
And the velocity of the particles:

$$U=\sqrt{\frac{2\Delta E}{m_e}}\,m/s \qquad (3)$$

$m_e=9.1*10^{-31}kg$
This is the classical particles mass.
For their oscillations we used Schrodinger Equation (Bayani, 2010).
As below:

$$\frac{d^2}{dx^2}u(x)+\big(E-V(X)\big)u(x)=0 \qquad (4)$$

If it is true that all calculations are in one dimensional and for free particles also their potential energy also kept to zero then:

$V(X)=0$

So as:

$$\frac{d^2}{dx^2}u(x)+k^2u(x)=0$$

$$K^2=\frac{2m}{\hbar^2} \qquad (5)$$

Solving the equation would give us the particles of the plasma oscillations (Bayani, 2010).
$U(x) = A\sin kx + B\cos kx$(6)
Then for the plasma oscillation of pair particles (Thoma, 2009).
):

$$\omega_p=\sqrt{\frac{2m_e\Delta E}{\hbar^2}}(7)$$

$$\omega_p=\sqrt{\frac{4\pi ne^2}{m_e}}\,Rad/s$$

From which the numerical density of the plasma would be as:

$$n_e=\frac{m_e{\omega_p}^2}{4\pi e^2}(8)$$

For one degree of freedom we have (Pauli, 1923):
$E=1.5T$ (9)
$T=0.66\,\frac{E}{K}$ (10)
KIt is the Boltzmann constant that is:
$K=1.38*10^{-23}$ j/k
We put all of our achievements into the table 1:

Table.1 Electron–Positron Plasma Parameters Based upon Selected Time Ranges (Log-Log unit).

Logt	-15	-14	-13	-12	-11	-10	-9
LogΔE	-18.178	-19.178	-20.178	-21.178	-22.178	-23.178	-24.178
Log U	6.079	5.579	5.079	4.579	4.079	3.579	3.079
Logωp	10.02	9.52	9.02	8.52	8.02	7.52	7.02
Log f	10.214	9.716	9.214	8.716	8.214	7.716	7.214
Log n	52.982	50.983	48.982	46.983	44.982	42.983	40.982
Log T	4.491	3.491	2.491	1.491	0.491	-0.508	-1.508

After above mentioned calculations we put our achievements into the diagrams 1 to 6

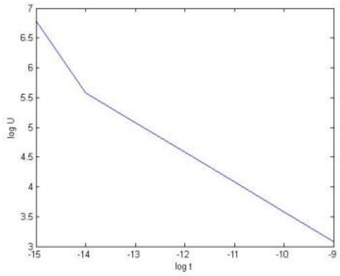

Figure 1. Velocity Variation versus Time for Electron- Positron Plasma

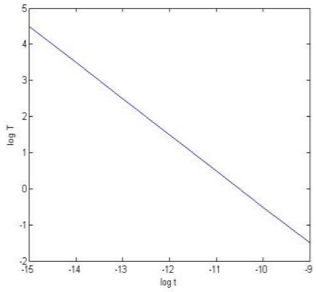

Figure 2. Temperature versus time variation for Electron- Positron Plasma

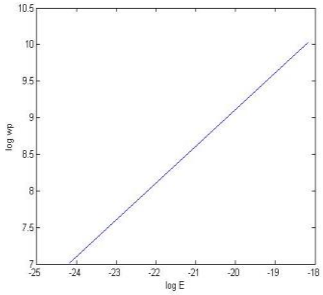

Figure 3**.** Angular frequency versus energy for Electron- Positron Plasma

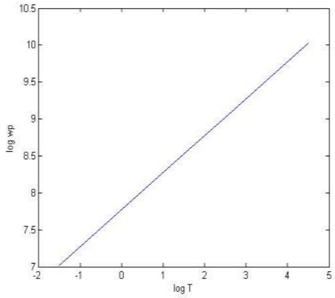

Figure 4. Angular frequency versus temperature for Electron- Positron Plasma

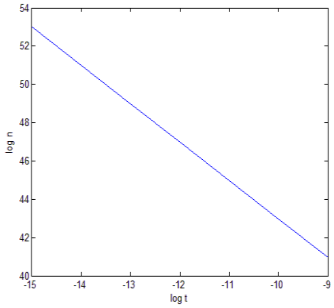

Figure 5. Electron density versus time variation for Electron- Positron Plasma

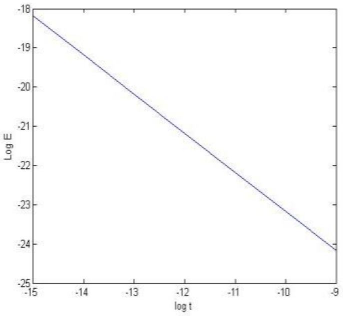

Figure 6. Energy versus time variation for Electron- Positron Plasma

Electron-positron plasma parameters

1-If pair annihilation is take place we may have triplet gamma radiation or singlet one (with special occurrence probabilities)(Pauli, 1923).

2-Binding energy of the positronium formation that is the Hydrogen’s lightest isotopes would the half of that of the Hydrogen normal atoms, this is because of the reduced mass of the former atoms refer to the normal Hydrogen atoms (Falkenburg, 2007).

CONCULSION

Conclusions remarks

It is true that particles and antiparticles are mirror image of each other that some scientists believed that pair production is a photonic process with the need of heavy nucleus, in other hand antiparticles could be produced by conversion of the particles field (Emami, 2013; Massimi, 2005).

Anyhow our nano to fem to second range time of the electron-positron particles plasma contain the following achievements:

1-For these special created plasma considerations in the time ranges from nanosecond to fem to second Ranges the most important needs are the particles energy and velocity that are in the classical limitations.

2-Their ranges of oscillation are in the range of10ex10to10ex7Hz.These ω_p belong to the waves about satellite to VHF Band.

3-The plasma numerical density also would be about 3.3*10ex26-3*10ex20.

4-The numerical density of the plasma make this plasma plausible in the instrumental plasmas.

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