A New Proof of Existence of Saleh Fundamental Particles (Sub-Photons) In the Big Bang Phenomenon

$$(R_{Saleh\ Particle} = 10^{-6}\ R_{Photon})$$

 Considering that the smallest, fastest and lightest particle in the world is the photon; if we intend to calculate the volume and density of the Big Bang based on the photon, we can write the following equations:

$$m_T = 10^{53}\ kg$$
$$m_p = 1.67 \times 10^{-35}\ kg$$
$$r_p = 1.2 \times 10^{-17}\ m$$
$$n = \frac{m_T}{m_p} = \frac{10^{53}}{1.67 \times 10^{-35}} \Rightarrow n = 6 \times 10^{87}$$
$$V_p = \frac{4}{3}\pi r_p^3 = \frac{4}{3}\pi(1.2 \times 10^{-17})^3 \Rightarrow V_p = 7.23 \times 10^{-51}\ m^3$$
$$\rho_p = \frac{m_p}{V_p} = \frac{1.67 \times 10^{-35}}{7.23 \times 10^{-51}} \Rightarrow \rho_p = 2.31 \times 10^{15}\ kg/m^3$$
$$V_{BB} = nV_p = 6 \times 10^{87} \times 7.23 \times 10^{-51} \Rightarrow V_{BB} = 4.33 \times 10^{37} m^3$$
$$V_{BB} = \frac{4}{3}\pi r_{BB}^3 \Rightarrow r_{BB}^3 = \frac{4.33 \times 10^{37}}{\frac{4}{3}\pi} \Rightarrow r_{BB} = 2.18 \times 10^{12} m$$

$$\rho_{BB} = \frac{m_T}{V_{BB}} = \frac{10^{53}}{4.33 \times 10^{37}} \Rightarrow \rho_{BB} = 2.31 \times 10^{15}\ kg/m^3$$

Where m_T and m_p are the total mass of universe and photon rest-mass, r_p is the radius of photon, n is the maximum number of photons in the universe, V_p and ρ_p are the volume and density of photon and V_{BB}, r_{BB} and ρ_{BB} are the volume, radius and density of the universe at big bang moment.

According to calculations, the volume of the Big Bang is a sphere with radius from the center of Sun to the Jupiter, and its density is $10^{15}\ kg/m^3$. It is clear that these equations and calculations show that the photon cannot be an appropriate choice for the nature of the Big Bang mass. But if we consider a particle with a radius of one millionth of a photon, the equations are as follows:

$$r_{sp} = 10^{-6}\ r_p$$
$$V_{sp} = \frac{4}{3}\pi r_{sp}^3 = \frac{4}{3}\pi(1.2 \times 10^{-23})^3 \Rightarrow V_{sp} = 7.23 \times 10^{-69} m^3$$
$$V_{BB} = nV_{sp} = 6 \times 10^{87} \times 7.23 \times 10^{-69} \Rightarrow V_{BB} = 4.33 \times 10^{19} m^3$$
$$V_{BB} = \frac{4}{3}\pi r_{BB}^3 \Rightarrow r_{BB}^3 = \frac{4.33 \times 10^{19}}{\frac{4}{3}\pi} \Rightarrow r_{BB} = 2.18 \times 10^6 m$$

$$\rho_{BB} = \frac{m_T}{V_{BB}} = \frac{10^{53}}{4.33 \times 10^{19}} \Rightarrow \rho_{BB} = 2.31 \times 10^{33}\ kg/m^3$$

Where r_{sp} and V_{sp} are the radius and volume of sub-photon.

According to the above equations, volume of Big bang sphere is about the size of the moon with a density of about $10^{33}\ kg/m^3$ and could meet the expectation that we have from the Big Bang (low volume and very high compression and density).

Notice 1:

Considering that hydrogen is the simplest and most basic element in the world with an electron that revolves around a proton, when we consider one millionth of it, it is a photon that exists in a proton. [1]

The sub-photon that we are looking for is one-millionth of a photon, which we call "Saleh particle", and it can be said that Saleh particle is a particle equal to a millionth of a photon.

$$R_{Saleh\ Particle} = 10^{-6}\ R_{Photon}$$
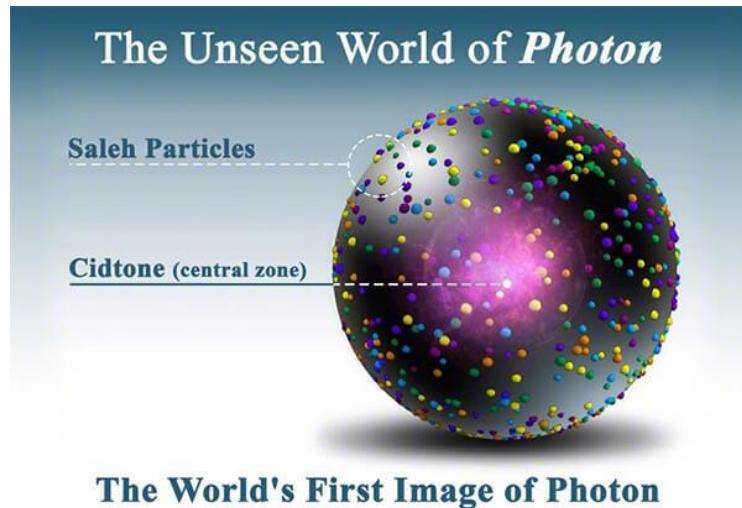
Notice 2:

Whenever we talk about compression in physics, it is expected that the radius of any objects would be reduced by a fraction of the initial volume, or a tenth times, and in the same way, its volume will also decrease to the power of three times. But in the case of the sub-photon, the radius of the photon would be reduced by 10^{-6} times, and its volume would be reduced by 10^{-18} times.

In this case, it cannot be said that the word compression is meaningful, but the structure of the photon is divided into smaller structures, like the nucleus of atoms, which is divided into its smaller components, such as electrons, protons and neutrons.

References:
[1] \bibitem[Saleh et al.(2020)]{2020APS..DNPSH.006S} Saleh, G., Alizadeh, R., Dalili, E., Noorbakhsh, A.\ 2020.\ Superstring Theory & The Structure of Electron, Proton and Neutron.\ APS Division of Nuclear Physics Meeting Abstracts.