Abstract: Big Bang Nucleosynthesis

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The 1920's had seen a radical transformation in the way thinkers theorized about the universe: the monumental shift from regarding the cosmos as conditioned by the laws given under a framework of Newtonian mechanics toward describing it thermodynamically (started in the 19th century), sparked a litany of new ideas in the fields of astrophysics and cosmology after the '20s, as well as drawing participation from many chemists interested in nuclear physics. For the next few decades, Big Bang and Steady State theories would contend for supremacy in the race for a cosmological model, one that could account for how heavier atomic nuclei were and had been synthesized. Two revolutionary 20th century observations that shifted the scientific support for Big Bang Theory were the discoveries made by Edwin Hubble – the redshift of light coming from distant galaxies was proportional to their distance from an observer – and those made by Arno Penzias and Robert Wilson – the presence of Cosmological Background Microwave Radiation (CBR). Once an expanding universe became a reality, early attempts to describe the production of heavy nuclei from pre-existing nucleons had tended to fail (procure inaccurate results) because the calculations treated the present universe in the radiation regime. Big Bang Theory, though, predicts two regimes: a radiation-filled universe, and a matter-dominated universe. Our intent is to briefly outline the very early history of an expanding, cooling universe and the conditions which needed to have been met in order for nucleosynthesis (NS) to occur, as predicted by Big Bang Theory. This entails that we introduce three important concepts which constitute the basis of NS Theory. The first includes how to predict the temperature of the universe (radiation regime) for a given time. Secondly, we will explain the reaction from a photon γ to a particle/antiparticle pair $p+/p-$ and show at what temperature this can occur. Lastly, we will consider how the "deuterium bottleneck" is passed and what follows as a result.

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