Origin of Solar System in context of the chemical evolution of the Milky Way Galaxy

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Galaxies formed within 1 billion years (Gyr) after the origin of the universe in Big Bang. Our Milky Way galaxy formed with the merger of proto-galaxies. Further, accretion of intergalactic gas resulted in the formation of various galactic components viz., halo, thin and thick disc, bulge and bar. Galactic Chemical Evolution (GCE) simulations are performed to understand the formation and evolution of the Milky Way galaxy. We have developed GCE simulations using N-body Monte Carlo technique. Our GCE models predict the elemental abundance distribution up to Iron peak elements, C, N, O, Mg, Si, Ca, Ti, Fe, and Zn throughout the galaxy and solar neighbourhood. In our simulations, the galaxy is radially divided into eight annular rings of 2 kpc width each from 2-18 kpc of galactic center, and the evolution of each ring is monitored over the galactic time scale. An ensemble of stars in the mass range 0.1-100 $M_{\odot}$ is formed and evolved over mass and metallicity dependent life spans. The nucleosynthetic yields ejected from stars of various generations enrich the Interstellar gas. Further, the next generation of stars forms out of enriched gas with higher metallicity. Along with elemental abundance trends, results are given for various galactic observables such as, star formation rate, supernova rates (SNIa, II & Ib/c), surface mass density of gas and stars and metallicity etc[1].

During the evolution of the our galaxy, formation of Solar System occurred ~4.56 Gyr ago at a distance of 8-10 kpc from the galactic center. For solar neighbourhood, the values for metallicity and [Fe/H] are assumed to be ~0.0143 and 0, respectively [2]. Further, GCE models are developed to explain the abundance trends of Short lived radio nuclides (SLRs), ^{26}Al, ^{36}Cl, ^{41}Ca, ^{53}Mn and ^{60}Fe in the galaxy and solar neighbourhood [3]. The formation of solar system is simulated to occur inside a stellar cluster as a natural consequence of the evolution of the galaxy. Based on the observed abundance of SLRs in the solar system, a hypothesis has been proposed for a possible scenario responsible for the presence of SLRs in the solar system.

[1] Sahijpal, S., & Kaur, T., (2018), MNRAS, 481(4), 5350-5369. [2] Asplund, M., et al., (2009), ARA&A, 47, 481-522. [3] Kaur, T. and Sahijpal, S., (2019), MNRAS, 490(2), 1620-1637