PHYSICS & ASTRONOMY SEMINAR

"On the Effects of Initial Mass Function on the Galactic Chemical Enrichment"

Presented by:

Sabyasachi Goswami

Visiting Researcher

Trieste, Italy

Abstract:
Context: There is mounting evidence that the stellar initial mass function (IMF) could extend much beyond the canonical Mi ~100, Msun limit, but the impact of such hypothesis on the chemical enrichment of galaxies still remains to be clarified.

Aim: We aim to address this question by analysing the observed abundances of thin- and thick-disc stars in the Milky Way with chemical evolution models that account for the contribution of very massive stars dying as pair-instability supernovae.

Method: We built new sets of chemical yields from massive and very massive stars up to Mi ~ 350 Msun, by combining the wind ejecta extracted from our hydrostatic stellar evolution models with explosion ejecta from the literature. Using a simple chemical evolution code we analyse the effects of adopting different yield tables by comparing predictions against observations of stars in the solar vicinity.

Results: After several tests, we focus on the [O/Fe] ratio which best separates the chemical patterns of the two Milky Way components. We find that with a standard IMF, truncated at Mi ~ 100 Msun, we can reproduce various observational constraints for thin-disc stars, but the same IMF fails to account for the [O/Fe] ratios of thick-disc stars. The best results are obtained by extending the IMF up to Mi = 350 Msun and including the chemical ejecta of very massive stars, in the form of winds and pair-instability supernova explosions.

Conclusions: Our study indicates that PISN played a significant role in shaping the chemical evolution of the Milky Way thick disc. By including their chemical yields it is easier to reproduce not only the level of the alpha-enhancement but also the observed slope of thick-disc stars in the [O/Fe] vs [Fe/H] diagram. The bottom line is that the contribution of very massive stars to the chemical enrichment of galaxies is potentially quite important and should not be neglected in chemical evolution models.

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PSLB 112