Contribution ID: **84** Type: **not specified**

Constraining Supernova Ia progenitors by their locations in host galactic disc

Wednesday, 14 June 2023 15:45 (15 minutes)

Over the past decade, substantial evidence has emerged supporting the presence of diverse progenitor channels leading to Type Ia Supernovae (SNe Ia). Among these channels, there are SNe Ia originating from carbon-oxygen white dwarfs with sub-Chandrasekhar masses. These white dwarfs undergo detonation and explosion triggered by primary detonation in the helium shell, which has been accreted from a companion star. This double-detonation model predicts a correlation between the age of the progenitor system and the near peak brightness: the younger the exploding progenitors, the brighter the supernovae. Here, we present our recent achievements, demonstrating the validity of the anticipated correlation. To accomplish this, we studied the spatial distribution of nearby SNe Ia within host galactic discs and estimate the ages of their progenitor populations using various approaches, including the analysis of SNe light curve decline rates versus the vertical age gradients in discs, the distances from host spiral arms, and versus the stellar population properties in the star formation desert phenomenon and beyond.

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Session Classification: Wednesday afternoon session