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Publication Date:
2003

Permanent Link:
https://doi.org/10.3929/ethz-a-004584543

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Star Formation and Metal-enrichment History in Clusters and in the Field from SNe

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Abstract Being closed boxes, galaxy clusters are excellent laboratories for studying the source of metals. The iron mass in clusters is about 5 times larger than could have been produced by core-collapse SNe, assuming the stars in cluster galaxies formed with a standard IMF. Type-Ia SNe have been proposed as the alternative dominant iron source. We use our HST measurements of the cluster SN-Ia rate at high redshift to study the cluster iron enrichment scenario. The measurements can constrain the star-formation epoch and the SN-Ia progenitor models via the mean delay time between the formation of a stellar population and the explosion of some of its members as SNe-Ia. The low observed rate of cluster SNe-Ia at $z \sim 1$ pushes back the star-formation epoch in clusters to $z > 2$ and argues for a short delay time. Analysis of the redshift distribution of *field* SNe-Ia points to *long* delay times, unless the cosmic star formation history is more constant than many recent determinations. Thus, cluster enrichment by core-collapse SNe from a top-heavy IMF may remain the only viable option.