

Based on the light curve evolution, we assumed that the explosion occurred 6 days before the discovery ($2,455,872 \pm 4$ JD), resulting in an adiabatic cooling phase lasting 8 days, similarly to SN 1993J. Since the duration and the decreasing rate of the cooling branch depends mainly on the progenitor size, we could infer from it a progenitor radius of $\approx 500\text{--}600 R_{\odot}$, like a supergiant star. Our modeling rules out models with He core mass $> 5M_{\odot}$, i.e. main sequence masses above $20 M_{\odot}$. Such a lower limit for the progenitor mass could indicate the possibility of a binary origin, although the radio light curve does not show strong deviations, typically signature of the presence of a companion star.

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PHASE MIXING OF POPPED STAR CLUSTERS

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As star clusters are expected to form with low star formation efficiencies, the gas in the cluster is expelled quickly and early in their development: the star cluster pops. This leads to an unbound stellar system. Previous N-body simulations have demonstrated the existence of a stepped number density distribution of cluster stars after popping, both in vertical position and vertical velocity, with a passing resemblance to a Christmas tree. Using numerical and analytical methods, we investigate the source of this structure, which arises due to the phase mixing of the out-of-equilibrium stellar system as it evolves in a background analytical potential. Considering only the vertical motions, we construct a theoretical model to describe the time evolution of the phase space distribution of stars in a Miyamoto-Nagai disk potential and a full Milky-Way type potential comprising bulge, halo and disk components, which is then compared with N-body simulations. Using our theoretical model, we investigate the possible observational signatures and the feasibility of detection.

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DETAILED DIFFERENTIAL CHEMICAL ANALYSIS OF A METAL POOR STAR: NEW EVIDENCES ABOUT PLANET FORMATION

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The present project emphasizes on the study of metal-poor stars, with and without planets, to investigate the existence (or not) of a connection between anomalies in the chemical composition and the presence of planets by inspecting the high resolution spectra ($R = 65\,000$), in order to derive chemical abundances with high precision using the differential technique. In this method, measurements of equivalent widths of the target star are compared to a standard star with predetermined photospheric parameters that are similar to those of the target star (effective temperature, surface gravity and metallicity). Therefore, we have compared the star HD111232 (standard) with HD020794, such that the first holds a hot Jupiter-type planet and around the second one there are three super-Earths. These solar-type stars are moderately metal-poor and had their spectra collected with the MIKE spectrograph at the 6.5m Magellan telescope in the Las Campanas Observatory. Among the main results, we have derived the classical photospheric parameters and chemical abundances of refractory and volatile elements with such a high precision, particularly with errors about 0.01 dex, which is essential for the study of chemical connection between planets and star. We have also added to the differential method the spectral synthesis of molecular bands and atomic lines to recover abundances of volatile elements such as carbon, nitrogen and oxygen. We thus present the parameters effective temperature, surface gravity, metallicity [Fe/H], microturbulence velocity and differential elemental abundances. For some elements, we have performed comparisons of the abundances measured by spectral synthesis with those obtained directly through measurements of equivalent widths. Specifically, the preliminary abundance difference $\delta[E/H]$ is 0.04(7) dex for carbon, 0.12(14) for nitrogen and 0.08(7) for oxygen.

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