# SURP Research Summary
# Light Curve Analysis of a Young Type II-L Supernova

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This summer, I worked on a research project about a young Type II-L supernova (SN) called KSP-ZN7090, under the supervision of Prof. Dae-Sik Moon. In this project, I analyzed images of KSP-ZN7090 taken by the Korea Microlensing Telescope Network (KMTNet). What's interesting about this SN is that it is one of the earliest detected Type II-L supernovae (SNe) to date, first observed by KMTNet less than one day after its explosion on October 12, 2020. Type II-L SNe are a rare class of core-collapse SNe, and so they are of great interest to astrophysicists in understanding SNe origins. What's mostly unknown is their early behaviour immediately after the explosion, which contains natal information of how they explode. Hence, it is fortunate that KSP-ZN7090 was detected and observed from such an early time. For these reasons, we have chosen to study KSP-ZN7090, and it is our hope that through it we can better understand the nature of SNe.

In the first part of this project, I performed photometry in order to generate KSP-ZN7090's light curve, which is a plot of the SN's brightness over time. There were several challenges in the process of making the light curve. The first problem was uncertainties contributed by nearby stars in estimating the SN's brightness, which was solved by applying image subtraction. I also conducted binning of several adjacent images of the same filter when necessary, in order to minimize the effects of lunar illumination and also to improve the signal-to-noise ratios. Lastly, I applied colour corrections (due to differing filter systems) and extinction corrections (due to interstellar dust) to obtain the final light curve. After finalizing the light curve, I fitted power law models to the early light curve in order to find key parameters such as the SN's epoch of first light, and polynomial functions in Monte Carlo simulations to obtain the epoch of maximum brightness.

Through my work, I found that KSP-ZN7090 has a relatively fast rise and rapid decline rate compared to other Type II SNe. The next steps of this project would be to estimate other physical parameters such as the SN's Nickel-56 mass and the progenitor's mass and radius, and also to determine the types of physical processes at work in the SN explosion. KSP-ZN7090 is a very unique SN, and I plan to continue this project after SURP in order to learn more about SNe, with the end goal of better understanding how SNe explode. Finally, I would like to thank Prof. Moon and other members of the KMTNet Supernova Program team: Prof. Maria Drout, Chris Ni, and Hao Xu, who have given me invaluable help and advice in this project. I would also like to thank the SURP committee for organizing this amazing experience this summer.

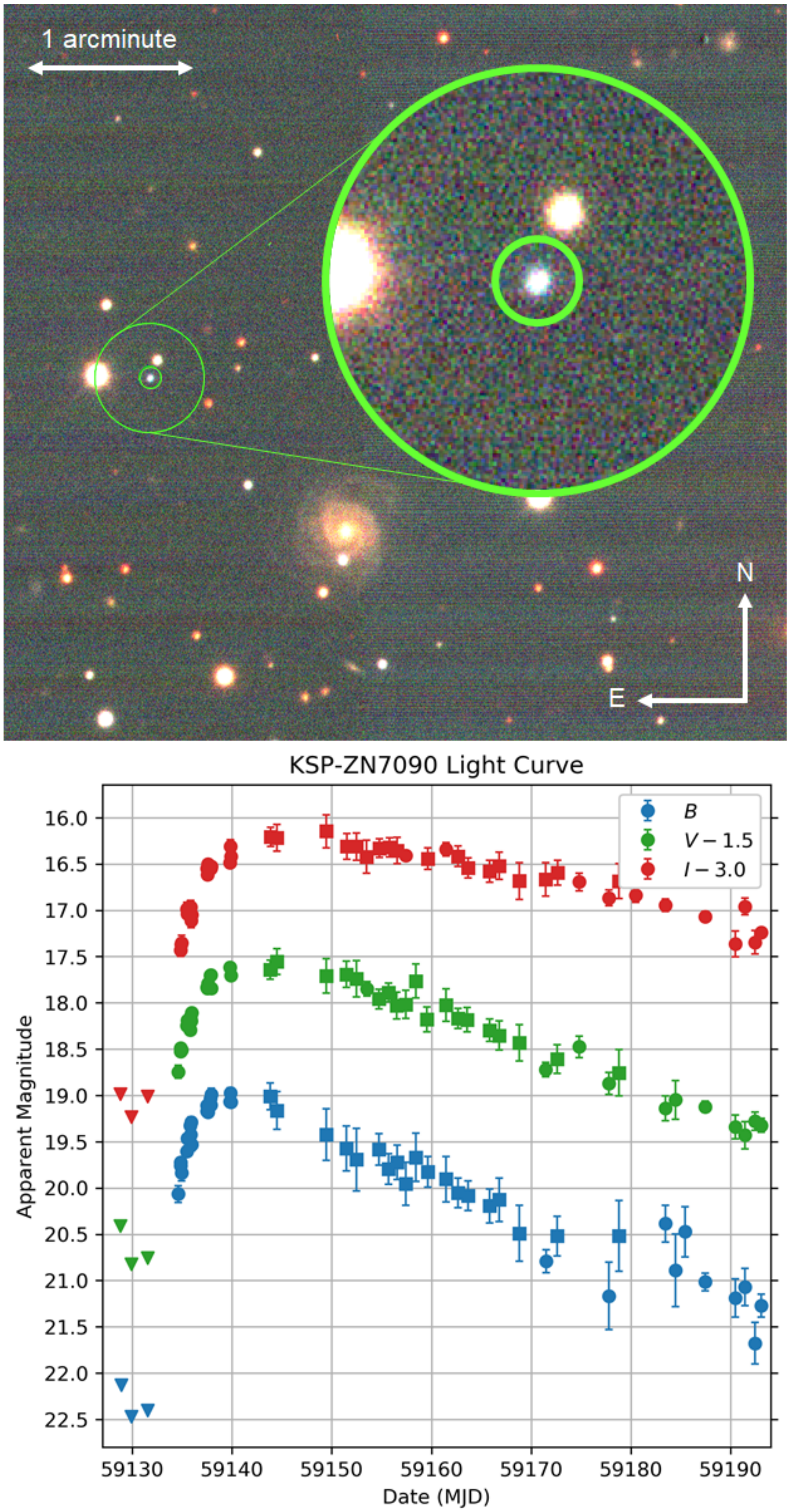


Figure 1: False colour RGB image of KSP-ZN7090 near its $I$ band peak (top), and KSP-ZN7090's light curve (bottom).