The Unexplored Dusty Nova LMCN 2009-05a in the Large Magellanic Cloud

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We present a detailed spectrophotometric study of nova LMCN 2009-05a, located in the Large Magellanic Cloud (LMC). Photometric observations reveal a dust dip in the optical light curve, classifying it as a D-class nova. Light curve analysis yields t2 and t3 decline times of approximately 46 and 80 days, respectively, placing the nova in the category of moderately fast novae. Spectroscopic observations cover multiple phases, including pre-maximum, early decline, and nebular. The spectra are initially dominated by hydrogen Balmer and Fe II lines with P-Cygni profiles, which later transition into pure emission. During the optical minimum, a discrete absorption feature was observed in the Hα and [O I] line profiles, corresponding to the disappearance of the redward part of the profile near the onset of the photometric minimum. Such a feature has previously been reported only in novae V5668 Sgr and V339 Del. The physical and chemical properties during the early decline and nebular phases were analyzed using the photoionization code CLOUDY. Dust temperature, mass, and grain size were estimated through spectral energy distribution (SED) fitting to the WISE data. On day 395 post-outburst, we estimate the dust temperature to be approximately 700 K. Furthermore, we examined the correlation between dust condensation time and t2 for LMC novae and compared it with Galactic novae. Both samples follow a similar power-law trend, indicating a consistent dust formation mechanism.