

DEEP VLT/MUSE OBSERVATIONS OF SNR 0509-67.5

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We present the analysis of deep (~ 27 hours on-source) VLT/MUSE observations of the supernova remnant SNR 0509-67.5 in the Large Magellanic Cloud. The $H\alpha$ line profiles were analyzed across the remnant, identifying both narrow and broad components that exhibit azimuthal variations in their parameters – fluxes, centroids, and widths. We compare theoretical predictions of broad-line widths to our measurements at 231 positions along the forward shock, where proper motion was determined using HST images taken 10 years apart. In some locations, the observed broad-line widths are significantly smaller than expected for the measured shock velocities assuming full electron-proton equilibration, suggesting efficient cosmic-ray acceleration in those regions. Also, the broad-line width is found to be larger on the northeastern side, indicating a higher shock velocity; however, this contradicts astrometric measurements. Additionally, the broad-line centroid is blue-shifted on the southwestern side, suggesting that the nearer limb of the supernova remnant appears brighter. The narrow-line centroid displays an east-west gradient, which may reflect a velocity gradient in the ambient medium. In contrast, the narrow-line width reveals a bipolar pattern, with slightly broader values in the southeast and northwest – possibly indicating enhanced cosmic-ray efficiency in these regions.