

## ALMA CO Observations toward the Gamma-Ray Supernova Remnant W28

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Investigating the molecular clouds surrounding a supernova remnant (SNR) is essential in understanding the acceleration and diffusion processes of cosmic rays because the clouds act as targets for cosmic-ray protons to produce gamma-rays via the hadronic processes. We present new observations of TeV gamma-ray SNR W28 with the Atacama Large Millimeter/submillimeter Array (ALMA) in  $^{12}\text{CO}(J=2-1)$  and  $^{13}\text{CO}(J=2-1)$  emission lines (PI: H. Sano). Thanks to ALMA's unprecedented sensitivity and angular resolution of  $\sim 5$  arcseconds (or  $\sim 0.05$  pc), we unveiled filamentary distributions of molecular clouds which are bright in TeV gamma-rays. The typical widths of molecular filaments are less than  $\sim 0.1$  pc, possibly suggesting that both the low- and high-energy cosmic-ray protons can easily diffuse the entire filaments and produce the hadronic gamma-rays. Indeed, the good spatial correspondence between the molecular clouds/filaments and TeV gamma-rays is the same as the previous studies using the NANTEN radio telescope and H.E.S.S. (Aharonian et al. 2008). These findings have the potential to advance the theories of cosmic-ray acceleration and diffusion in SNRs by considering the effects of an inhomogeneous gaseous medium. In this presentation, we will discuss the close relation between the NANTEN/ALMA detected molecular clouds/filaments and TeV gamma-rays.

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