

Tycho SNR : possible interaction with molecular cloud

Lee, Jae-Joon¹, Koo, Bon-Chul¹, Tatematsu, Ken'ichi²

¹*SEES, Seoul National University*

²*NAOJ*

The Tycho supernova remnant (SNR), as one of the few historical SNRs, has been widely studied in various wavebands. There are observational evidences suggesting that the Tycho SNR is expanding in a medium with density gradient and possibly interacting with dense ambient medium toward the northeast direction. From the FCRAO CO survey of the outer Galaxy, we have identified a patch of molecular clouds in this area and have conducted a follow-up observation with Nobeyama 45m telescope. The high-resolution (16") Nobeyama data shows that the molecular cloud surrounds the SNR along the northeastern boundary. We suggest that the Tycho SNR and the molecular cloud are located in the Perseus arm and that the dense medium interacting with the SNR is possibly the molecular cloud. We also discuss about the possible connection between the molecular cloud and the Balmer-dominated optical filaments, and it is suggested that the preshock gas may be accelerated within the cosmic-ray and/or fast neutral precursor. Anyhow, the shock structure of Tycho is not dominated by cosmic-ray and this gives a upper limit on cosmic-ray injection rate of 4×10^{-5} .