Studying High-mass Microquasars with HAWC

This talk focusses on high-mass microqusars as observed in TeV gamma rays using the High Altitude Water Cherenkov (HAWC) observatory. High-mass microquasars (HMMQs) are powerful particle accelerators, but their mechanism of the high-energy emission is poorly understood. Therefore, we took a close look at the known HMMQs within the field of view of HAWC, namely, LS 5039, Cyg X-1, Cyg X-3, and SS 433 and report the most stringent limit to date on the gamma-ray emission above 10 TeV for each HMMQ. We also provide a multi-wavelength spectral energy distribution for each HMMQ to better understand their emission mechanism.

Furthermore, by stacking the fitted likelihoods of the HMMQs, we constrain the fraction of the jet luminosity in emitting very-high-energy (VHE) gamma rays and high-energy neutrinos. We show that the non-detection of VHE gamma rays implies a significant magnetic field, which challenges synchrotron radiation as the dominant mechanism of the microquasar emission between 10 keV and 10 MeV.

Finally, as a follow-up study we perform time dependent analysis on each HMMQ to look for any periodic variations in their flux by generating daily light curves and computing Lomb-Scargle periodograms based on the light curves, from which we evaluate whether or not HAWC can observe any periodicity due to orbital modulation.

Chang Dong Rho
University of Seoul