Gamma-ray and Neutrino Emission from Supernova Remnants and Molecular Clouds

R.T. Burley[a], S. Einecke[a], G.C. Hill[a] and G.P. Rowell[a]

[a]*School of Physical Sciences, The University of Adelaide, Adelaide, South Australia 5005, Australia.*

High-energy gamma rays and neutrinos can be produced due to the hadronic interactions between protons escaping particle accelerators such as supernova remnants (SNRs) and nearby target material such as molecular clouds (MCs). By modelling the diffusion of protons escaping SNRs and interacting with nearby MCs in our Galaxy, we can predict the resulting gamma-ray and neutrino fluxes at Earth. Looking towards MCs as production sites for neutrinos may help identify Galactic neutrino sources, as previous searches primarily look at the sites of cosmic-ray accelerators. Observing either the gamma rays or neutrinos at large energies can also point towards Galactic PeVatrons.

In this contribution, we will introduce a 3D modelling to calculate the gamma-ray and neutrino fluxes expected from hadronic interactions between all possible combinations of SNRs and MCs in our Galaxy. We will present a list of SNR and MC combinations that, under the right conditions, could produce a gamma-ray flux above 100 TeV observable by the Cherenkov Telescope Array (CTA). These combinations also produce neutrino fluxes that may be observable by future neutrino detectors such as IceCube-Gen2 and KM3NeT.