Galactic Bulge VHE Tau-neutrino and Gamma-ray Monitor with Ashra-1 and NTA detectors

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The Ashra phase-1 (Ashra-1) detector has been developed to efficiently capture fine detail images from air-shower (AS) Cherenkov (CE) and fluorescence (FL) light induced by the Earth-skimming ν_τ and γ-ray ASs. Based on the performance of Ashra-1, we are planning a new extension, namely the Neutrino Telescope Array (NTA), an AS imaging ν and γ-ray observing system for *Unambiguous Discovery and Identification of Non-thermal Hadronic Processes in the Universe.* The four NTA stations are planned to be located on Mauna Loa at 3000-3500 m a.s.l. (layout of the NTA Summit Array). Using the four stations, it will monitor AS phenomena occurring in the volume of air above the surface, including the largest volcano, Mauna Loa, the Big Island of Hawaii and the surrounding ocean, and can efficiently detect CE and FL light from ν_τ ASs with both short and long decay lengths and γ-ray ASs. The sensitivity of NTA ν_τ with detailed MC is sufficient to probe the Pevatron as an extension of astrophysical neutrino flux detected by IceCube and a prediction of cosmogenic neutrino. The point-back accuracy is evaluated to be within 0.2° of the original direction of ES ν_τ's on the PeV scale. As a first step in the deployment of a minimal systematic detector, we propose to simultaneously observe the 10 TeV-10 PeV γ-rays from the Galactic bulge (GB) with Ashra-1 and the Earth-skimming ν_τ's with NTA to clearly identify the Pevatrons and comprehensively understand the emission process there. The effective detection area of Ashra-1 and that of NTA for the Galactic bulge γ-rays with the energies around 1 PeV is more than 10 and 100 times respectively larger than that of a 500 m-scale ground array. The GB can also be considered an intriguing testing site for the discovery of elementary particles predicted by the non-standard theory of particle physics. NTA can perform the sensitive indirect search for PeV-scale WIMP dark matter (DM) and non-standard new particles, with much better effective detection area for tau neutrinos from DM annihilation in the GB, especially above 10 PeV, the complementary sensitive energy region for IceCube.

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