CATMAD: Synthesis of nonthermal emission from 3-D MHD simulations of astrophysical plasmas

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CATMAD is a project aimed at developing an advanced diagnostic tool for the analysis of nonthermal emission stemming from supernova remnants and astrophysical plasmas.

Through post-processing of state-of-the-art 3-D MHD simulations of supernova remnants, we synthesise the multi-wavelength emission (from the radio band to gamma-rays) to get an accurate comparison with actual observations. We here present our preliminary results, showing our module for the synthesis of hadronic gamma-ray emission. The module incorporates the time-dependent acceleration of protons at the shock front, their escape during the evolution of the remnant, and the inelastic collisions with ambient protons in the post-shock material. We provide an application of our diagnostic tool to the Galactic supernova remnant IC443, by showing that we can self-consistently reproduce its gamma-ray emission and obtain important insight on the efficiency of the proton acceleration process, and on the cosmic-ray energy and spectral shape.

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