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A novel multimessenger study of Starburst galaxies: implications for neutrino astronomy

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Starburst galaxies (SBGs) and more in general starforming galaxies represent a class of galaxies with a high star formation rate (up to 100 Mo/year). Despite their low luminosity, they can be considered as guaranteed "factories" of high energy neutrinos, being "reservoirs" of accelerated cosmic rays and hosting a high density target gas in the central region. The estimation of their point-like and diffuse contributions to the neutrino astrophysical flux measured by IceCube can be crucial to describe the diffuse neutrino spectral features as well as the peculiar point-like excess like NGC1068.
To this aim we used the most updated gamma-ray catalog of this class of objects to perform a multimessenger study and describe their gamma-ray emission through a calorimetric scenario.
A whole sky analysis was performed through a blending of the measured spectral indexes and obtained a multi-component description of extragalactic background light (EGB), high energy starting events (HESE) and high-energy cascade IceCube data. Remarkably, we found that, differently from recent prototype scenarios, the spectral index blending allows starburst galaxies to account for up to 40% of the HESE events at 95.4% CL and favors a maximal energy of the accelerated cosmic rays at tens of PeV. The same calorimetric approach has been applied also to the known SBGs within 100 Mpc, considering, where possible, a source-by-source description of the star formation rate obtained from IR and UV observations. On this regard we showed how Future CTA measurements will be crucial to link the observed gamma-ray fluxes from resolved SBGs with their star-forming activity as well as to disentangle the cosmic-ray transport inside the core of these galaxies. The expected neutrino emission, related to this scenario, are then compared with what IceCube and ANTARES have seen at TeV energies as well as with what can be expected from the incoming KM3NeT.

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