Cosmic rays in the superwinds of starburst galaxies

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Abstract

Starburst galaxies have an exceptionally high rate of star formation and hence also of supernova explosions. The combined effects of the supernovae and the stellar winds of massive stars produce a high-temperature cavity in the central region of these galaxies. The very hot gas expands adiabatically and escapes from the galaxy creating a superwind which sweeps matter from the galactic disk. The collision of the superwind with the halo and swept-up material generates shock waves and turbulent conditions where cosmic rays might be accelerated up to high energies. We detail our results for the acceleration rate, particle distributions, and non-thermal radiation resulting from this astrophysical scenario in the case of nearby galaxy NGC 253. We conclude that the superwind of NGC 253 and other similar starbursts are sources of cosmic rays up to _˜10ˆ18 eV. The acceleration of iron up to 10ˆ20 eV seems to be extremely difficult because of the constraints imposed by the radio and gamma-ray emission observed by VLA, the *Fermi* satellite, and H.E.S.S.

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