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# Exploring galactic wind superbubbles by multimessenger observations

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Galactic winds are one of the most spectacular phenomena we observe in the Universe.
They are common in active galaxies, and can be powered either by stellar feedback typical of star forming galaxies or by active galactic nuclei (AGN).
These winds have a bubble structure characterized by an external forward shock expanding in the circumgalactic medium and an internal reverse shock separating the cool and fast wind from the hot shocked wind.
While the forward shock is unlikely to be able to accelerate particles efficiently for a long time, at the reverse shock the necessary conditions for efficient acceleration may be present.
The power of these outflows ranges from $10^{39}\,\mathrm{erg\,s^{-1}}$ up to $10^{45}\,\mathrm{erg\,s^{-1}}$ making galactic wind bubbles powerful particle accelerators.

We develop a model for particle acceleration at the termination shock of such superbubbles analysing the differences between AGN-driven and starburst-driven scenarios.
This is done solving the transport equation in the entire wind bubble structure accounting for diffusion, advection and energy losses.
We show that the maximum energy in these systems can be larger than $10^2$ PeV.
We finally explore the associated multimessenger observables both in terms of escaping particles and hadronic byproducts such as gamma-rays and neutrinos produced via $pp$ and $p\gamma$ interactions.

## Keywords

Particle acceleration; galactic winds; multi-messenger

## Collaboration

## other Collaboration

## Subcategory

Theoretical Results

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