SUPERNOVAE

Break out the wind

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Supernovae can drive winds that potentially shape the evolution of galaxies. But how exactly does that happen? Drummond Fielding, Eliot Quataert and Davide Martizzi use numerical simulations to address the finer details of the energy transfer process. They build on the idea that clusters of supernovae contribute to 'super-bubbles' through their ejecta. By focusing on the bubbles before and after they break out of the galactic disks, Fielding et al. determine the amount of energy and mass from supernovae that goes into the galactic wind and confirm that supernovae alone can drive galactic winds.

Firstly, the authors show that super-bubbles are able to reach the necessary disk scale height (roughly 100 parsecs) before the supernovae switch off and stop injecting energy (roughly 30 million years after the explosion). Simulations of a super-bubble pushing through the disk into a vertically stratified interstellar medium (ISM) reveal a sharp drop in the cooling rate; the wind blows a 'chimney' through the ISM for efficient venting that can carry the wind to the far galactic halo. These simulations compare well with the properties of the archetypical starburst galaxy M82 as well as further star-forming galaxies at redshift $z \approx 2$. It remains to be seen whether the inclusion of magnetic fields, thermal conductivity, self-gravity and other feedback processes will affect the qualitative picture produced by this idealized numerical simulation.

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