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Impact of radiation-modulated cooling on stellar feedback

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Strong radiation fields can change the ionization state of metals and hence cooling rates. In order to understand their effects on the momentum transfer from radiation and supernova feedback, we perform a suite of radiation-hydrodynamic simulations with radiation-modulated metal cooling. For this purpose, we pretabulate the metal cooling rates for a variety of spectral shapes and flux levels with the spectral synthesis code, Cloudy, and accurately determine the rates based on the local radiation field strength. We find that the inclusion of the radiation-modulated metal cooling decreases the total radial momentum produced by photoionization heating by a factor of up to 3 due to enhanced cooling at temperature T~1e3-1e4K. The amount of momentum transferred from the subsequent SN explosions, however, turns out to be little affected by radiation, as the main cooling agents at T~1e5–1e6 K are only destroyed by soft X-ray radiation which is generally weak. We further discuss the total momentum budget in various conditions.

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