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Where will supersymmetric dark matter first be seen?

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If the dark matter consists of supersymmetric particles, Gamma-ray observatories such as the Large Area Telescope aboard the Fermi satellite may detect annihilation radiation from the haloes of galaxies and galaxy clusters. Much recent effort has been devoted to searching for this signal around the Milky Way's dwarf satellites. Using a new suite of high-resolution simulations of galaxy cluster haloes (the Phoenix Project), together with the Aquarius simulations of Milky-Way-like galaxy haloes, we show that higher signal-to-noise and equally clean signals are, in fact, predicted to come from nearby rich galaxy clusters. Most of the cluster emission is produced by small subhaloes with masses less than that of the Sun. The large range of mass scales covered by our two sets of simulations allows us to deduce a physically motivated extrapolation to these small (and unresolved) masses. Since tidal effects destroy subhaloes in the dense inner regions of haloes, most cluster emission is then predicted to come from large radii, implying that the nearest and brightest systems should be much more extended than Fermi's angular resolution limit. The most promising targets for detection are clusters such as Coma and Fornax, but detection algorithms must be tuned to the predicted profile of the emission if they are to maximize the chance of finding this weak signal.

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