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Measuring the dark matter velocity anisotropy to the cluster edge

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Dark matter dominates the properties of large cosmological structures such as galaxy clusters, and the mass profiles of the dark matter have been measured for these equilibrated structures for years using X-rays, lensing or galaxy velocities. A new method has been proposed, which should allow us to measure a dynamical property of the dark matter, namely the velocity anisotropy. For the gas a similar velocity anisotropy is zero due to frequent collisions, however, the collisionless nature of dark matter allows it to be non-trivial. Numerical simulations have for years found non-zero and radially varying dark matter velocity anisotropies. Here we employ the method proposed by Hansen and Pifaretti (2007), and developed by H{\o}st et al. (2009) to measure the dark matter velocity anisotropy in the bright galaxy cluster Perseus, to near 5 times the radii previously obtained. We find the dark matter velocity anisotropy to be in good agreement with the results of numerical simulations, however, still with large error-bars. At half the virial radius we find the velocity anisotropy to be non-zero at 1.7σ , thus confirming the collisionless nature of dark matter.

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