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X-ray - cosmic shear cross-correlations: first detection and constraints on baryonic effects

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We report a first detection, at very high significance (25σ), of the cross-correlation between cosmic shear and the diffuse X-ray background, using data from the Dark Energy Survey and the ROSAT satellite. The X-ray cross-correlation signal is sensitive to the distribution of the surrounding gas in dark matter haloes. This allows us to use our measurements to place constraints on key physical parameters that determine the impact of baryonic effects in the matter power spectrum. In particular, we determine the mass of haloes in which feedback has expelled half of their gas content on average to be $\log_{10}(M_c/M_\odot) = 13.643^{+0.081}_{-0.12}$, and the polytropic index of the gas to be $\Gamma = 1.231^{+0.015}_{-0.011}$. This represents a first step in the direct use of X-ray cross-correlations to obtain improved constraints on cosmology and the physics of the intergalactic gas.

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