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Principal Component Analysis For The Dark Sector[1] MAXWELL AIFER, Haverford College, TRISTAN SMITH, Swarthmore College, DANIEL GRIN, Haverford College — The physics of dark matter is still poorly understood, although its effects are evident in the angular power spectrum of the Cosmic Microwave Background (CMB) temperature map. Because there is not currently a preferred physical model of dark matter, a model-independent description is more justified, an example being the Generalized Dark Matter (GDM) formalism. In GDM, dark matter is a fluid whose equation of state is a free function of time, and whose sound speed is a free function of time and wavenumber. This formalism can be applied in a finite-dimensional setting by expanding each of the GDM functions (the sound speed and equation of state) in a basis of functions, and treating the expansion coefficients as model parameters. Principal Component Analysis (PCA) can be used to reduce the dimensionality of high-dimensional data, and so is a natural way to find structure in the GDM parameter space. An approximate simulation of fluid perturbations before recombination is implemented, which has two fluids: a coupled photon/baryon fluid and a GDM fluid. This model is used to compute a prediction of the CMB power spectrum. PCA is used to identify the functional components of the equation of state and sound speed which have the most influence on the CMB power spectrum when varied.

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