Title:	Minkowski Tensors in Three Dimensions: Probing the Anisotropy Generated by Redshift Space Distortion
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Abstract:	We apply the Minkowski tensor statistics to three-dimensional Gaussian random fields. Minkowski tensors contain information regarding the orientation and shape of excursion sets that is not present in the scalar Minkowski functionals. They can be used to quantify globally preferred directions and also provide information on the mean shape of the subsets of a field. This makes them ideal statistics to measure the anisotropic signal generated by redshift space distortion in the low-redshift matter density field. We review the definition of the Minkowski tensor statistics in three dimensions, focusing on two coordinate invariant quantities, ${W}_{1}^{0,2}$ and ${W}_{2}^{0,2}$. We calculate the ensemble average of these 3 × 3 matrices for an isotropic Gaussian random field, finding that they are proportional to products of the identity matrix and a corresponding scalar Minkowski functional. We show how to numerically reconstruct ${W}_{1}^{0,2}$ and ${W}_{2}^{0,2}$ from discretely sampled fields and apply our algorithm to isotropic Gaussian fields generated from a linear ΛCDM matter power spectrum. We then introduce anisotropy by applying a linear redshift space distortion operator to the matter density field and find that both ${W}_{1}^{0,2}$ and ${W}_{2}^{0,2}$ exhibit a distinct signal characterized by inequality between their diagonal components. We discuss the physical origin of this signal and how it can be used to constrain the redshift space distortion parameter Upsilon ≡ f/b.
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