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Spin Texture on the Fermi Surface of Strained HgTe SAAD ZAHEER, STEVE YOUNG, University of Pennsylvania, DANIEL CELLUCCI, University of Georgia, JEFFREY TEO, CHARLES KANE, EUGENE MELE, ANDREW RAPPE, University of Pennsylvania — We present *ab initio* and $\mathbf{k} \cdot \mathbf{p}$ calculations of the Fermi surface of strained HgTe obtained by stretching the Zinc-Blende lattice along the (111) axis. Near the Fermi level, strained HgTe exhibits point-like accidental degeneracies between a two-fold degenerate and two non-degenerate bands along the (111) axis. The three bands disperse linearly in all directions about the degenerate points and their low energy physics is described by an effective four band $\mathbf{k} \cdot \mathbf{p}$ Hamiltonian. The Fermi surface consists of two ellipsoids which contact only at the point where the Fermi level crosses the two-fold degenerate band along the (111) axis. The spin expectation value on both ellipsoids is constrained to vanish along the (111) axis due to mirror symmetry about a plane that contains that axis. Furthermore the winding number of spins around the two ellipsoids changes from one end to the other indicating the existence of singular points in the spin texture. Indeed, the *ab initio* and $\mathbf{k} \cdot \mathbf{p}$ calculations confirm the existence of such spin singularities on the Fermi ellipsoids. We show that doping HgTe with Zinc atoms chemically strains the HgTe Zinc-Blende lattice and present *ab initio* calculations on HgZnTe that confirm the above results.

Saad Zaheer
University of Pennsylvania

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