Unusual Linear Magnetoresistance in Non-Metallic Topological Insulator Bi$_2$Te$_3$\textsuperscript{1} DONGXIA QU, J.G. CHECKELSKY, YEW SAN HOR, R.J. CAVA, N.P. ONG, Princeton University — ARPES experiments have shown that, in both Be$_2$Se$_3$ and Bi$_2$Te$_3$, the energy gap is crossed by a single surface state (SS) with Dirac-like dispersion [1,2]. Spin-resolved ARPES [1] shows that the spin of the SS has a Rashba-like coupling, consistent with the identification of these materials as topological insulators. To explore the surface-state transport properties in Bi$_2$Te$_3$, we have examined in detail the low-temperature ($T$) transport properties in crystals with non-metallic $\rho$ vs. $T$ profiles. At 0.3 K, we observe an unusual $H$-linear magnetoresistance (MR) that extends in field $H$ from 0.05 T to 14 T. The $H$-linear dependence is observed with $H \parallel c$ and $H$ in-plane. We discuss a scenario in which the $H$-linear MR arises from the effect of $H$ on the spins of the carriers in the topological SS. We also discuss a comparison with $H$-linear MR in Bi$_{1-x}$Sb$_x$.


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