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Time-reversal symmetry breaking type II Weyl state in $YbMnBi_2$

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Detection of Dirac, Majorana and Weyl fermions in real materials may significantly strengthen the bridge between high-energy and condensed-matter physics. While the presence of Dirac fermions is well established in graphene and topological insulators, Majorana particles have been reported recently and evidence for Weyl fermions in non-centrosymmetric crystals has been found only a couple of months ago, the "magnetic" Weyl fermions are still elusive despite numerous theoretical predictions and intense experimental search. In order to detect a time-reversal symmetry breaking Weyl state we designed two materials with Fermi velocities superior to that of graphene and I will present the experimental evidence of realization of such a state in one of them, $YbMnBi_2$. We model the time reversal symmetry breaking observed by magnetization measurements by a canted antiferromagnetic state and find a number of Weyl points both above and below the Fermi level. Using angle-resolved photoemission, we directly observe these latter Weyl points and a hallmark of the exotic state – the arc of the surface states which connects these points. Our results not only provide a fundamental link between the two areas of physics, but also demonstrate the practical way to design novel materials with exotic properties.