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*GdAlSi: A potential candidate for altermagnetic topological Weyl semimetal**

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and on MS Microsoft (https://tinyurl.com/yvpdvfe2)

Spintronics has emerged as a viable alternative to conventional electronics in the past few decades.

On one hand, discovery of topological phases of matter with protected spin-polarized states have shown promising applications while on the other hand, new magnetic materials have shown intriguing phases of collinear antiferromagnets with unconventional spin-splitters. In this work, we report the co-existence of these two interesting phases in a single material: GdAlSi. GdAlSi crystallizes in a body-centered tetragonal structure with a non-centrosymmetric space group I41md (109), as confirmed by our XRD and optical second harmonic generation experiments. The magnetization data indicates antiferromagnetic (AFM) ordering with an ordering temperature (TN) 32 K. Ab-initio calculations show GdAlSi to be a collinear antiferromagnetic Weyl semimetal (WSM) with an unconventional momentum-dependent spin splitting (also nomenclature as altermagnetism). Fermi arcs, a characteristic feature of WSMs, have been subsequently observed in angle-resolved photoemission spectroscopy (ARPES) measurements performed on GdAlSi single crystals. Electric and magnetic multipole analysis gives a deeper insight into the symmetry mediated momentum-dependent spin splitting which has a strictly non-relativistic origin. To the best of our knowledge, such coexistence of unconventional AFM order and non-trivial topology is unprecedented and has never been observed before in any material which makes GdAlSi a wonder material. Finally, we propose a device which can leverage this unique coexistence leading to practical and efficient topotronic application.

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