Magnetism in the bucked honey-comb lattice of Eu2Mg3Bi4

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A novel magnetic material, Eu2Mg3Bi4 in a previously unknown buckled honeycomb lattice was discovered by high-pressure and high-temperature methods. The Eu2Mg3Bi4 compound stabilizes in an orthorhombic, centrosymmetric crystal structure with the space group Cmca, where the Eu atoms are arranged in layers of buckled honeycomb lattices. The dominant antiferromagnetic interaction within the buckled honeycomb layers is confirmed based on the high Curie-Weiss fitting with TCW ~ -24 K. However, the long-range magnetism orders in the temperature range far below TCW. The two transitions observed at TN1 = 4.0 K and TN2 = 6.0 K likely originate from competing magnetic interactions in Eu2Mg3Bi4. Zero-field resistivity, and heat capacity measurements further confirm the two anomalies suggesting successive evolution of magnetic order parameters. The coexistence of rare-earth magnetism, strong spin-orbit coupling from the Bi atoms and the frustrated structural origin makes Eu2Mg3Bi4 a unique material to realize the design and control of magnetism from the structural aspects.