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Switchable Altermagnetism via Spin-Induced Improper Polarization

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Enabling reversible spin-splitting switching in stray-field-free altermagnets is promising for spintronic applications, but current routes remain largely confined to a narrow class of polar materials. We propose a broader approach based on spin-induced improper polarization in nonpolar dual-sublattice magnets. Using density-functional-theory calculations for $DyFeO_3$, we show that the relative Dy–Fe spin alignment selects the polarization, while the Fe sublattice controls nonrelativistic spin splitting. Spin-mode analysis identifies nonpolar Fe and Dy spin modes whose product transforms as the induced polar mode, enabling coupled switching: Fe-spin reversal switches both order-parameter signs, whereas Dy-spin reversal switches only the polarization. These results establish spin-induced improper polarization as a route to switchable altermagnetism in nonpolar bulk systems.