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Abstract for an Invited Paper
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Hidden Monopolar Order in Magnetoelectrics

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I will discuss a recently proposed [Monopole-based formalism for the diagonal magnetoelectric response, N. A. Spaldin, M. Fechner, E. Bousquet, A. Balatsky and L. Nordstrom, Phys. Rev. B 88, 094429 (2013)] form of hidden order – the magnetoelectric monopole – and its relationship to a material's magnetoelectric response. Using density functional calculations for the Li transition metal phosphate series, LiMPO_4 , with $M = \text{Mn, Fe, Co and Ni}$, I will show that materials with the same overall antiferromagnetic ordering can have distinct ferromonopolar or antiferromonopolar orderings, that lead to different, and in principle measurable, magnetoelectric responses. The current status and open questions in both the theoretical formalism and experimental verification will be outlined.