Tuning altermagnetic phases in $Ca_3Ru_2O_7$ under strain

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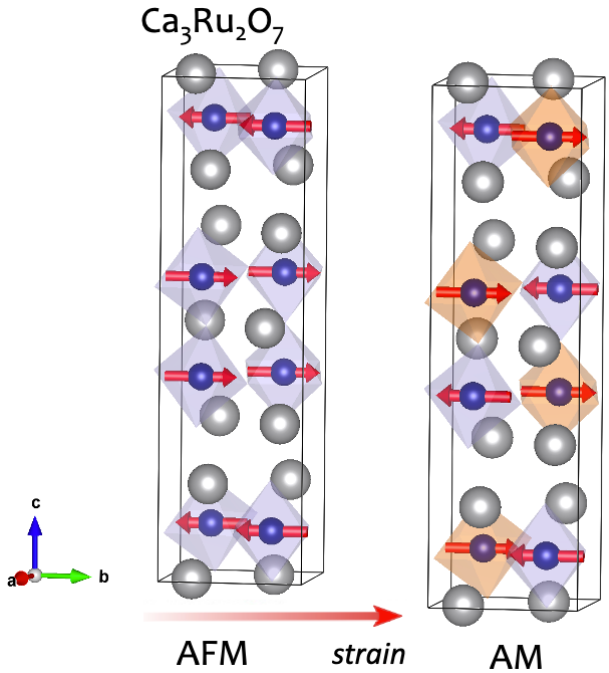
$Ca_3Ru_2O_7$ is an antiferromagnetic (AFM) polar metal considered a fascinating material due to its wide range of remarkable electronic phenomena, including colossal magnetoresistance, spin waves, and multiple phase transitions. Exploring these properties under external manipulation, such as electrical current, pressure, or strain, opens new pathways for understanding its electronic behavior and controlling its quantum states. In this talk, we address the theoretical challenges of describing the electronic properties of $Ca_3Ru_2O_7$ [1,2], and we explore the feasibility of manipulating its magnetic states through lattice deformation using *ab-initio* methods. Our study identifies potential altermagnetic (AM) states, a recently discovered elemental magnetic phase, and demonstrates that these states can be stabilized under strain. Furthermore, we discuss the underlying mechanisms behind the stability of the AM phase and propose a novel approach for tuning quantum states via AFM-to-AM transitions [3] in $Ca_3Ru_2O_7$ through lattice deformation.



Tuning magnetic phases from AFM-metal (ground state) to AM-insulator under strain.

[1] León, A. M., González, J. W., & Rosner, H. (2024). *Physical Review Materials*, *8*(2), 024411.
[2] I. Markovic, et al., *Proc. Natl. Acad. Sci. USA*, vol. 117, no. 27, pp. 15524–15529, 202.
[3] González, J. W., León, A. M., González-Fuentes, C., & Gallardo, R. A. (2024). *arXiv preprint arXiv:2408.08999*.