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## Altermagnetism and Flat band Enhanced AFM Fluctuation in Kagome CsCr3Sb5

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The CsCr3Sb5 exhibits superconductivity in close proximity to a density-wave (DW) like ground state at ambient pressure, however details of the DW are still elusive. Using first-principles density-functional calculations, we found its ground state to be a  $4\times 2$  altermagnetic spin-density-wave (SDW) at ambient pressure. The magnetic long range order is coupled to the lattice, generating  $4a_0$  structural modulation. Multiple competing SDW phases are present and energetically close, suggesting strong magnetic fluctuation at finite temperature. The kagome flat bands are closer to the Fermi level, which enhances strong antiferromagnetic spin fluctuations. Our random phase approximation analysis reveals a sublattice-momentum-coupling mechanism, where the antiferromagnetic fluctuations enhanced from unoccupied flat bands give rise to a leading  $S_{\pm}$  wave and a competing  $(d_{xy}, d_{x^2-y^2})$  - wave superconducting order.

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