Supplemental Materials: Magnetic Stability, Fermi Surface Topology, and Spin-Correlated Dielectric Response in Monolayer 1T-$CrTe_2$

A. Energy Convergence With Respect To Sampling In The Unit Cell of Ferromagnetic $CrTe_2$

Relaxation is performed on a unit cell until the force on each atom becomes less than 0.002 eV/Å and the total energy converges to within $10^{-}8$ eV. A cutoff energy surface of 600 eV was used for the plane-wave-basis. A Γ-centered Monkhorst-Pack of $13 \times 13 \times 1$ was used to sample the Brillouin zone for relaxation. After relaxation, the mesh was changed to be $n \times n \times 1$ where: $3 \leq n \leq 15$. Colinear self-consistent calculations were performed using different n values to find a suitable mesh for the unit cell.

In the figure below, the ground energy of the unit cell with respect to the size of a mesh $n \times n \times 1$ is shown. The value of n was allowed to go up to 25. Notice how the energy oscillates around the value $E = -16.2625$ eV, especially for values where $n \geq 10$. This oscillatory behavior is another indicator that the chosen mesh is suitable for the calculation. The mesh sizes of the supercells were picked with this criterion in mind.

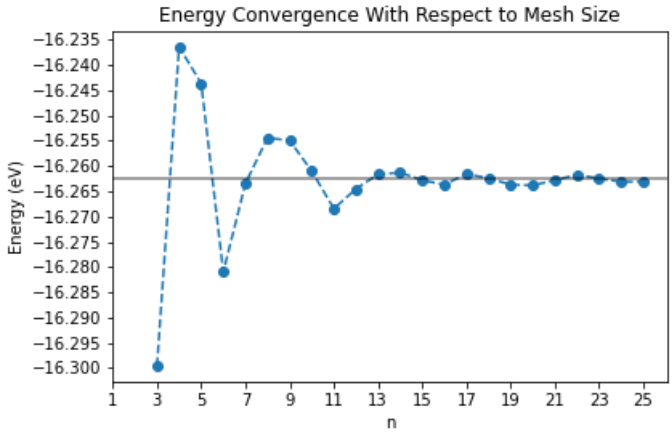

FIG. S1: Energy Convergence as a function of sampling points.

B. Ground Energy Convergence With Respect to Cutoff Energy In The Unit Cell of Ferromagnetic $CrTe_2$

The relaxed structure generated in the previous section was also used to perform colinear self-consistent calculations to test the convergence of the ground state energy against the energy cutoff surface used for the plane-wave-basis set. A mesh of $13 \times 13 \times 1$ was used for the calculation. The self-consistent calculations were performed until the total energy difference reached 10^{-8} eV.

$E_{cutoff}(eV)$	E_{total} (eV)
400	-16.260964
450	-16.261668
500	-16.262638
550	-16.262849
600	-16.262793
650	-16.262816
700	-16.263001

TABLE S1: Ground Energy Convergence with respect to energy cutoff

C. Additional Supporting Figures

The ground energy of the unit cell converges up to the 5^{th} significant digit when with an energy cutoff surface of at least 500 eV. Hence, we conclude that calculations performed using $E_{cutoff} = 500$ eV or more are sufficient to model

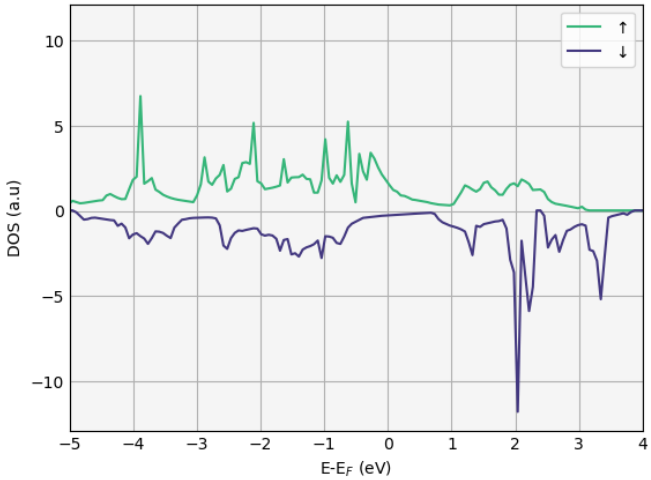

FIG. S2: DOS of the FM phase.

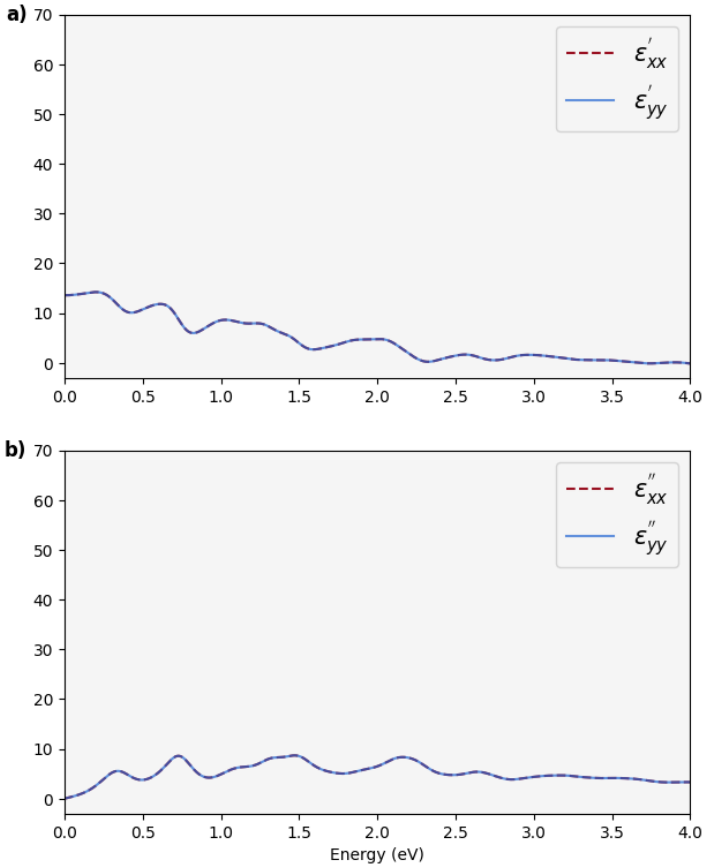

FIG. S3: Optical response of the FM unit cell along the x and y direction showing no anisotropy.

the behavior of the system.

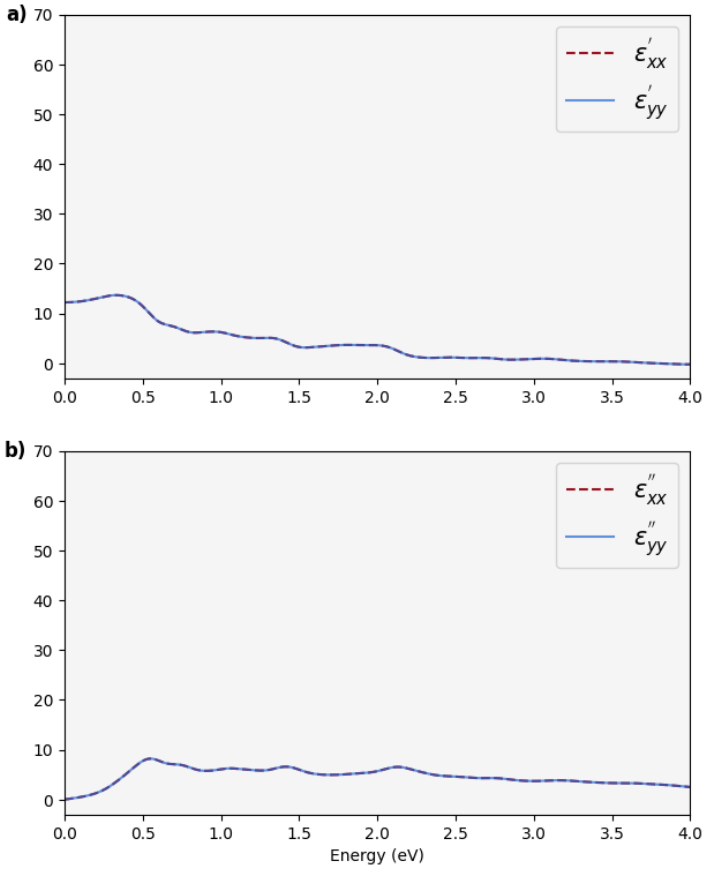

FIG. S4: Optical response of the FM-CDW supercell along the x and y direction showing no anisotropy.