- Competition between **CDW** and **antiferromagnetism**.
- **Electric control** of electronic correlations.
- Correlation-induced non-trivial **valley topology**.

Correlations and topology in buckled graphene superlattices

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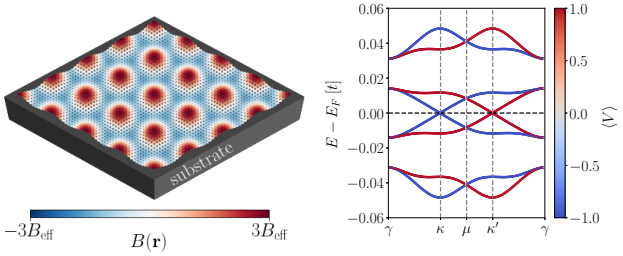
1 Motivation

- Buckled graphene superlattices
- buckling → strain → gauge fields → nearly flat bands
- Electronic instabilities



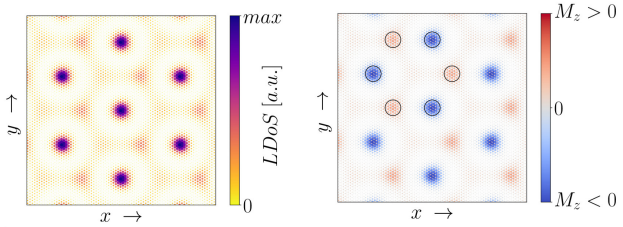
2 Atomistic model

- tight-binding with modulated hoppings + Hubbard

$$\mathcal{H} = -\sum_{\langle i,j\rangle,\sigma} t_{ij}(B_p) c^\dagger_{i\sigma} c_{j\sigma} + U \sum_i n_{i\uparrow} n_{i\downarrow} \qquad (1)$$

$$B_p(\mathbf{r}) = B_0 \sum_{i=1}^{3} \cos(\mathbf{b}_i \cdot \mathbf{r}) \qquad (2)$$

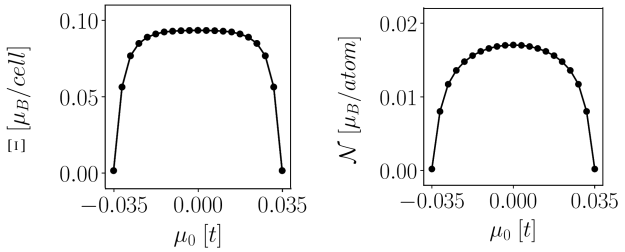
3 Magnetism and honeycomb superlattice



Local density of states and resulting magnetization for $L_M/l_B = 7$ (same as the experiment) and $U = t$.

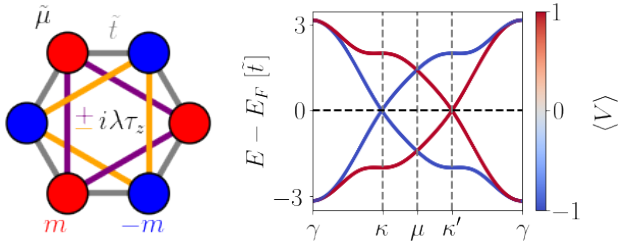
4 Breakdown of magnetic ordering

$$\mathcal{H}_{elec} = -\sum_i \mu(\mathbf{r}_i) c^\dagger_i c_i \ , \quad \mu(\mathbf{r}) = \mu_0 \sum_{i=1}^{3} \cos(\mathbf{b}_i \cdot \mathbf{r}) \qquad (3)$$



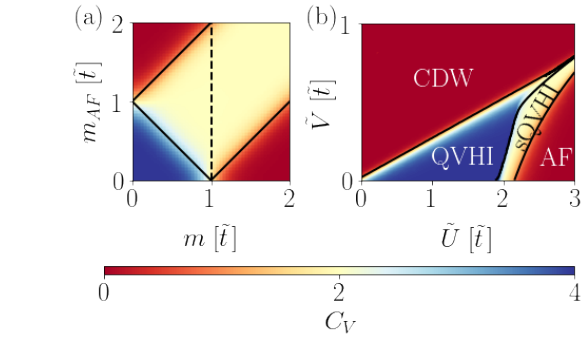
5 Low-energy theory and valley topology

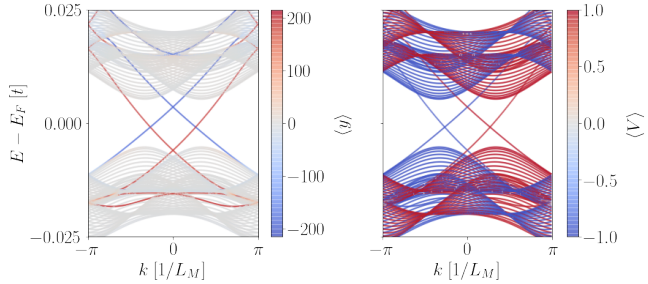
Kane-Mele Hamiltonian



$$m = 3\sqrt{3}\lambda =: M$$

Quantum valley Hall effect





Source code: 10.5281/zenodo.3829056 and 10.5281/zenodo.4685132

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