

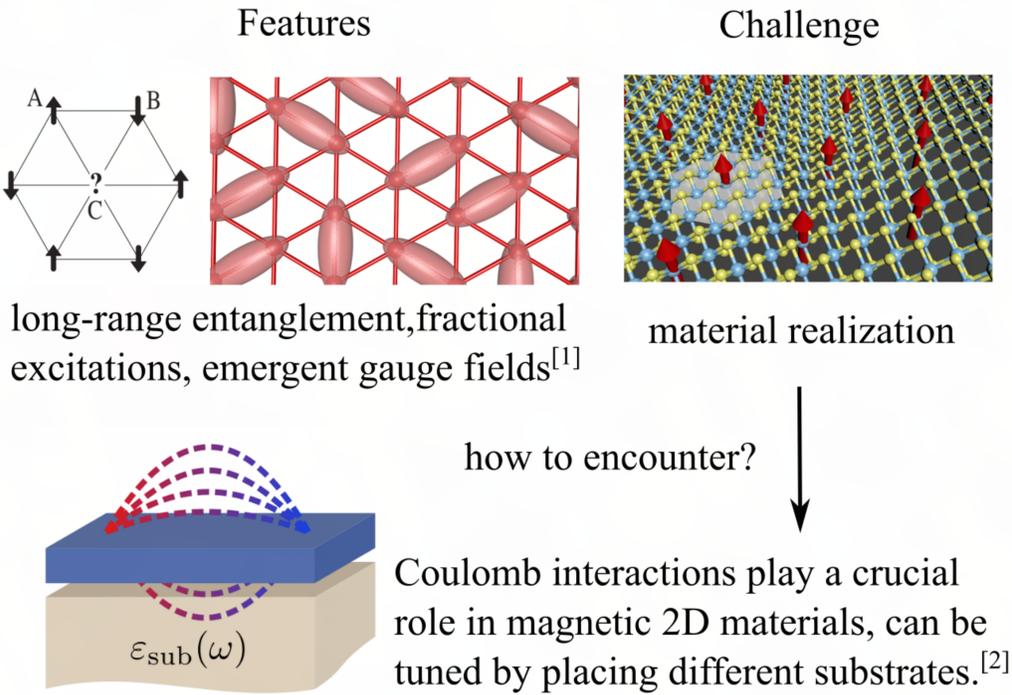
# Controlling magnetic frustration in 1T-TaS<sub>2</sub> via Coulomb engineered long-range interactions

Guangze Chen<sup>1</sup>, Malte Rösner<sup>2</sup>, Jose Lado<sup>1</sup>

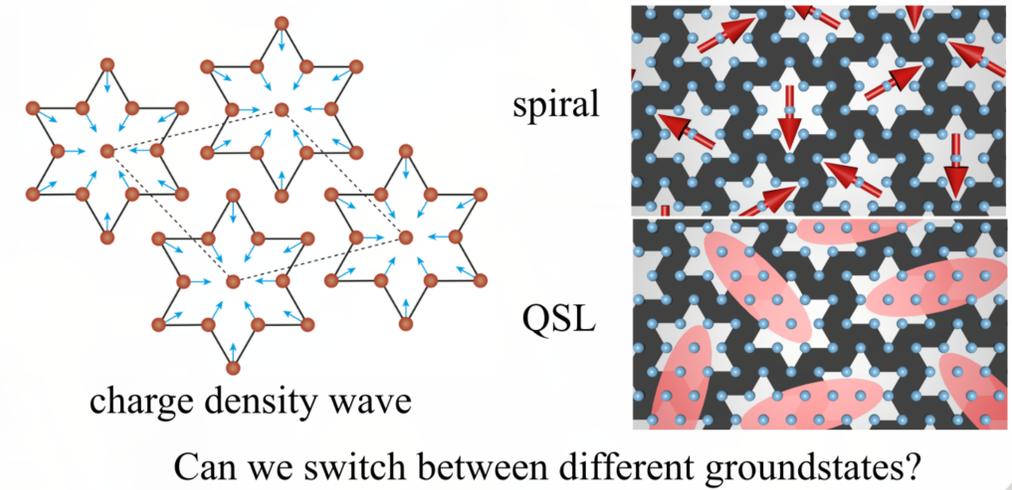
<sup>1</sup>Department of Applied Physics, Aalto University, Finland

<sup>2</sup>Institute for Molecules and Materials, Radboud University, The Netherlands

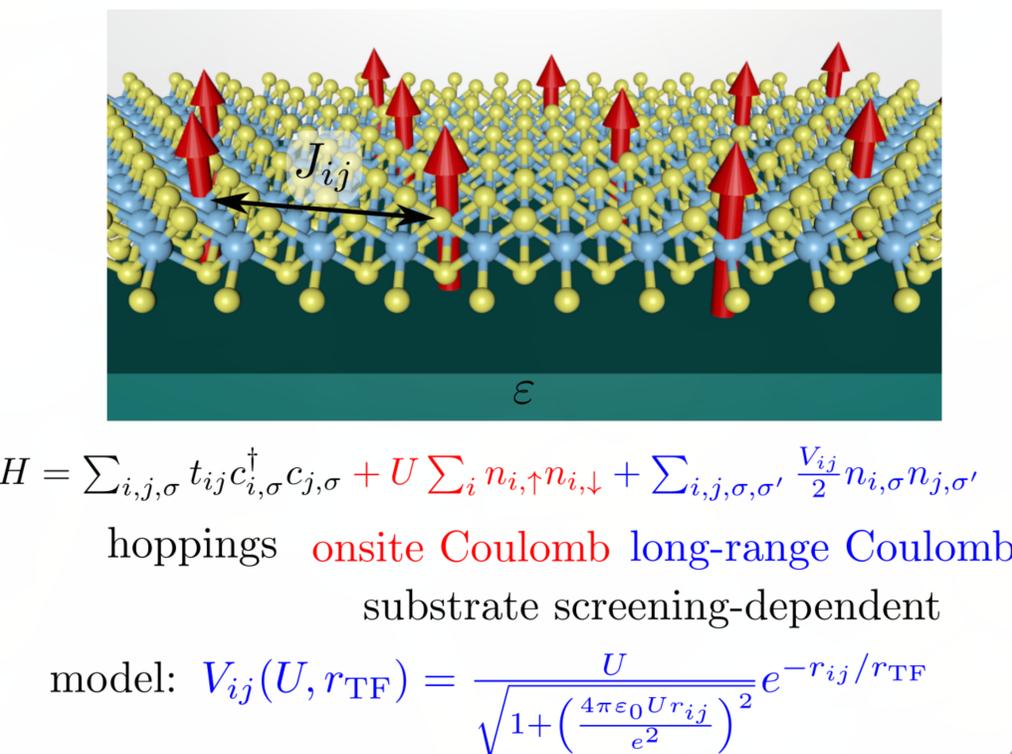
## Background on quantum spin liquid (QSL)



## Potential groundstates of 1T-TaS<sub>2</sub>



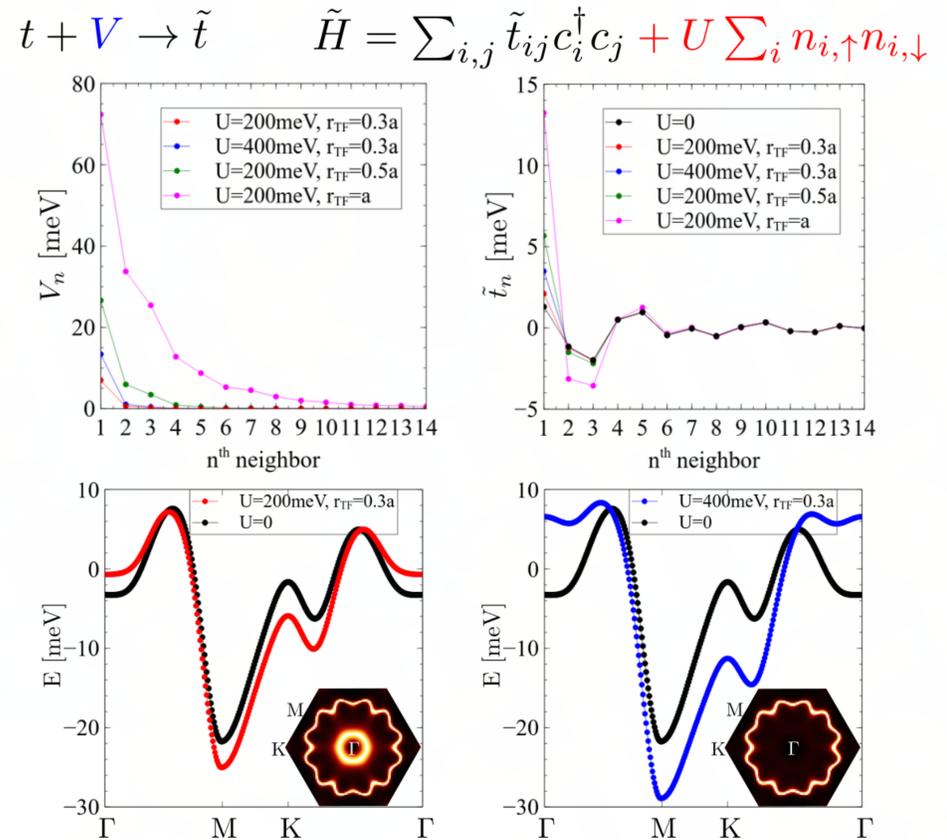
## Modelling Coulomb engineered 1T-TaS<sub>2</sub>



## Bibliography

- [1] L. Savary and L. Balents, Reports on Progress in Physics 80, 016502 (2016)  
 [2] C. Steinke, T. O. Wehling and M. Rösner, Phys. Rev. B 102, 115111 (2020)  
 [3] G. Chen, M. Rösner and J. L. Lado, arXiv:2201.07826

## Bandwidth renormalization

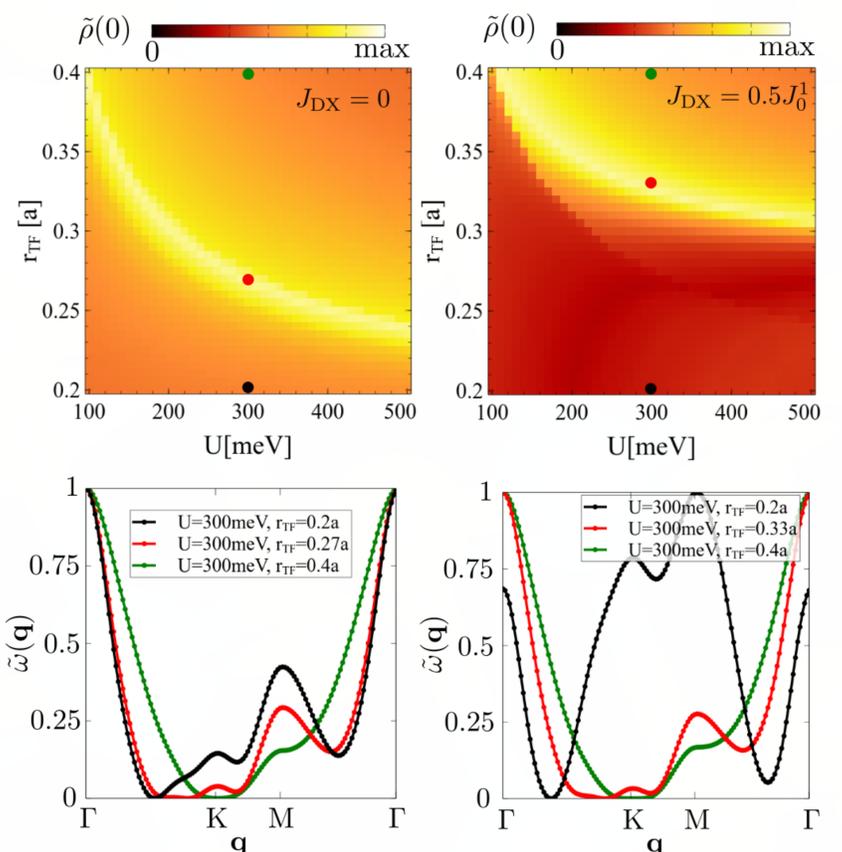


## Controlling magnetic frustration

$$J_{ij} = 2 \frac{\tilde{t}_{ij}^2}{U} \quad \mathcal{H} = \sum_{i,j} J_{ij} \mathbf{S}_i \cdot \mathbf{S}_j + J_{DX} \sum_{\langle i,j \rangle} \mathbf{S}_i \cdot \mathbf{S}_j$$

Magnetic configuration with wavevector  $\mathbf{q}$   $\mathcal{H} : \mathbf{q} \rightarrow \omega(\mathbf{q})$

$$\tilde{\rho}(\omega) = \int_{\mathbf{q} \in \text{BZ}} \frac{d^2 \mathbf{q}}{(2\pi)^2} \delta(\tilde{\omega}(\mathbf{q}) - \omega). \quad \text{frustration index: } \tilde{\rho}(0)$$



## Take home

Coulomb engineering with different substrates allows tuning magnetic groundstate of 2D magnetic materials, potentially driving them towards the QSL regime.<sup>[3]</sup>