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## Abstract

The interplay of topology, superconductivity, and many-body correlations has become a subject of intense research in condensed matter physics for the pursuit of nontrivial forms of superconducting pairing. Atomically thin topological materials – amongst them the quantum spin Hall (QSH) insulator [1] – provide a fertile ground to engineer electronic states and phases in van-der-Waals heterostructures. The topological edge states of such systems – strictly 1D electronic structures with linear (Dirac) dispersion and spin-momentum locking – have recently been shown to harbour a strongly correlated 1D low temperature ground state – the helical Tomonaga-Luttinger Liquid (TLL) [2]. The strength of its many-body correlations can be quantified by a single dimensionless parameter, the Luttinger parameter *K*, characterising the competition between the electrons' kinetic and electrostatic energies.

Here we show [3] that the many-body Coulomb interactions in such helical Luttinger Liquid – realized in epitaxial QSH heterostructures of monolayer  $1T'-WTe_2$  – can be effectively screened by the edge state's dielectric environment. This is inferred from temperature-dependent scanning tunnelling spectroscopy down to 4.2K, confirming universal scaling of the tunnelling density of states in bias voltage and temperature. We demonstrate tunability of the Luttinger parameter K, distinct on the different edges of the crystal, and extracted to high accuracy from a statistical analysis of tens of tunnelling spectra. We expect that our results will stimulate experimental and theoretical investigation into the interplay of topology and strong electronic interactions in 1D, also in the superconducting state, in which non-Abelian parafermions have been predicted.

## References

<sup>[1]</sup> Lodge et al., Atomically Thin Quantum Spin Hall Insulators. Advanced Materials **33**, 2008029 (2021).

<sup>[2]</sup> Stuehler et al. Tomonaga–Luttinger liquid in the edge channels of a quantum spin Hall insulator. Nat. Phys. 16, 47 (2020).

<sup>[3]</sup> Jia et al. under review