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String and brane techniques for surface science and nanotechnology

String theory is a well-known catalyst for seminal interactions between mathematics and physics. Theoretical physicists became aware of powerful mathematical tools like Lie algebra cohomology or the theory of complex manifolds when they had to use these methods to understand the quantum dynamics of relativistic strings.

It is well known that some of the mathematical techniques used in string theory also apply to two-dimensional critical systems, but it is not so widely known that some of the mathematical techniques used in brane world theories can also be adapted for calculations in low-dimensional electron systems.

The dynamics of electrons at surfaces, interfaces, and quantum wires is important for materials science and for the investigation of magnetic and thermodynamic properties of low-dimensional systems.

The talk will specifically discuss the mapping between half-order differentials and spinors for the description of fermions in low-dimensional systems, and the use of brane world techniques to describe the transition between surface and bulk properties of electrons in the presence of a surface or interface.