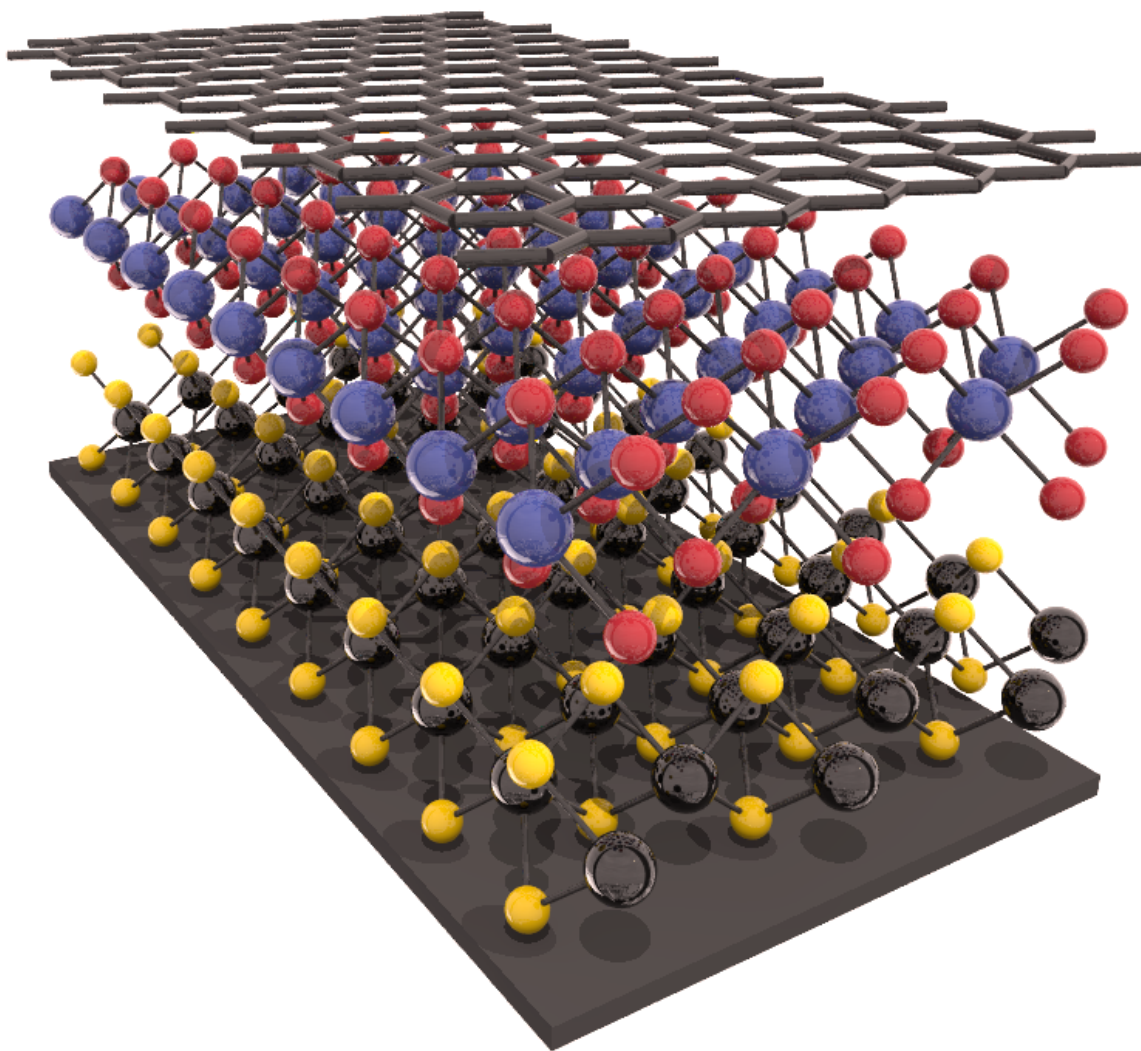


Breakthrough in 'wonder' materials paves way for flexible tech

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Credit: University of Warwick

Gadgets are set to become flexible, highly efficient and much smaller, following a breakthrough in measuring two-dimensional 'wonder' materials by the University of Warwick.

Dr Neil Wilson in the Department of Physics has developed a new technique to measure the electronic structures of stacks of two-dimensional materials – flat, atomically thin, highly conductive, and extremely strong materials – for the first time.

Multiple stacked layers of 2-D materials – known as heterostructures – create highly efficient optoelectronic devices with ultrafast electrical charge, which can be used in nano-circuits, and are stronger than materials used in traditional circuits.

Various heterostructures have been created using different 2-D materials – and stacking different combinations of 2-D materials creates new [materials](#) with new properties.

Dr Wilson's technique measures the electronic properties of each layer in a stack, allowing researchers to establish the optimal structure for the fastest, most efficient transfer of electrical energy.

The technique uses the photoelectric effect to directly measure the momentum of electrons within each layer and shows how this changes when the layers are combined.

The ability to understand and quantify how 2-D material heterostructures work - and to create optimal semiconductor structures - paves the way for the development of highly efficient nano-circuitry, and smaller, flexible, more wearable gadgets.

Solar power could also be revolutionised with heterostructures, as the atomically thin layers allow for strong absorption and efficient power conversion with a minimal amount of photovoltaic material.

Dr Wilson comments on the work: "It is extremely exciting to be able to see, for the first time, how interactions between atomically thin layers change their electronic structure. This work also demonstrates the importance of an international approach to research; we would not have been able to achieve this outcome without our colleagues in the USA and Italy."

Dr Wilson worked formulated the technique in collaboration with colleagues in the theory groups at the University of Warwick and University of Cambridge, at the University of Washington in Seattle, and the Elettra Light Source, near Trieste in Italy.

Understanding how interactions between the atomic layers change their [electronic structure](#) required the help of computational models developed by Dr Nick Hine, also from Warwick's Department of Physics.

More information: Neil R. Wilson et al. Determination of band offsets, hybridization, and exciton binding in 2D semiconductor heterostructures, *Science Advances* (2017). [DOI: 10.1126/sciadv.1601832](#)

Provided by University of Warwick

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