Scientists develop a nanometer-scale light bulb from monolayer MoS2

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A group of scientists led by University of Vienna Professor Thomas Muller have demonstrated a visible light source using an atomically thin monolayer MoS2. They attached small strips of a monolayer MoS2 to metal electrodes, put them in vacuum and passed a current through the filaments to cause them to heat up and produce light.

Layered transition metal dichalcogenide semiconductors, such as MoS2 and WSe2, exhibit a range of fascinating properties and are currently being explored for a variety of electronic and optoelectronic devices. These properties include low thermal conductivity and a large Seebeck coefficient, which make them promising for thermoelectric applications.

Moreover, transition metal dichalcogenides undergo an indirect-to-direct bandgap transition when thinned down in thickness, leading to strong excitonic photo- and electroluminescence in monolayers. In the new research, the scientists demonstrated that a MoS2 monolayer sheet, freely suspended in vacuum over a distance of 150 nm, emits visible light as a result of Joule heating. Due to the poor transfer of heat to the contact electrodes, the electron temperature can reach 1600 K.

Study co-author Prof. Perebeinos said. "This new type of light emitter we created can be integrated into chips and will pave the way towards the realization of atomically thin, flexible, and transparent displays, and a dichalcogenide semiconductor, based on-chip optical communications."

The results of the study have been published in the scientific journal *Advanced Materials*.

More information: Lukas Dobusch et al, Thermal Light Emission from Monolayer MoS2, *Advanced Materials* (2017). DOI: 10.1002/adma.201701304