

# Return of the vacuum tube

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Vacuum tubes have been retro for decades. They almost completely disappeared from the electronics scene when consumers exchanged their old cathode ray tube monitors for flat screen TVs. Their replacement - the semiconductor - is generally the cheaper, lighter, more efficient, and easier to manufacture of the two technologies. But vacuum tubes are more robust in high-radiation environments such as outer space. And since electrons travel faster in a vacuum than through a semiconductor, vacuum tubes are an intrinsically better medium for electricity.

An international team of researchers from NASA's Ames Research Center in Moffett Field, Calif., and the National Nanofab Center in Korea have combined the best traits of both technologies by making a tiny version of vacuum tubes that could be incorporated into circuits. Their prototype, a vacuum channel transistor, is just 150 nanometers long and was made using conventional semiconductor fabrication methods. Its small size allows it to operate at fewer than 10 volts, much less than a retro vacuum tube requires; with further work, the device could be made to use about 1 volt, which would make it competitive with modern semiconductor technology.

In a paper accepted to the American Institute of Physics' (AIP) journal *Applied Physics Letters*, the authors write that such a transistor could be useful for applications in hazardous chemical sensing, noninvasive medical diagnostics, and high-speed telecommunications, as well as in so-called "extreme environment" applications for military and space.

**More information:** "Vacuum nanoelectronics: back to the future? - gate insulated nanoscale vacuum channel transistor," is accepted to *Applied Physics Letters*.

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