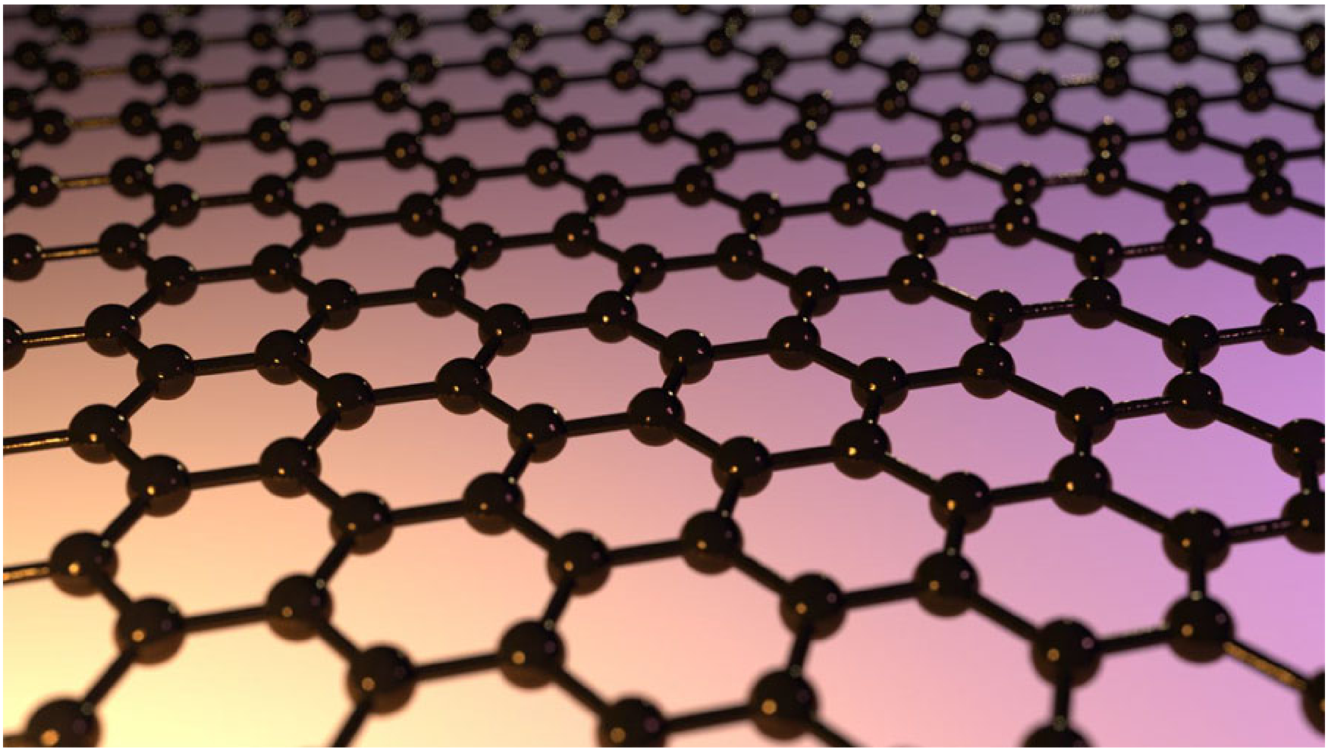
[Pure Graphene Generates Photocurrent Over Great Distances for Ultra-Efficient Energy Flow]

RIVERSIDE, Calif., Jan. 8, 2019 — An international research team has discovered a new mechanism for ultra-efficient charge and energy flow in pristine graphene. The team was co-led by professor Nathaniel Gabor from the University of California, Riverside.

The researchers fabricated graphene with no impurities (pristine graphene) into different geometric shapes, connecting narrow ribbons and crosses of graphene to rectangular regions of the material. They found that when light was shined on constricted areas of the graphene, a large photocurrent was created. The photocurrent occurred in a parameter regime that was different from previously observed photothermoelectric or photovoltaic photocurrents in graphene. In the pristine graphene, the photocurrent emerged exclusively at the charge neutrality point.



Although graphene has been studied vigorously for more than a decade, new measurements on high-performance graphene devices have revealed yet another unusual property. In ultraclean graphene sheets, energy can flow over great distances, giving rise to an unprecedented response to light. Courtesy of Max Grossnickle and QMO Labs, UC Riverside.

"We found that photocurrents may arise in pristine graphene under a special condition in which the entire sheet of graphene is completely free of excess electronic charge," Gabor said. "Generating the photocurrent requires no special junctions and can instead be controlled, surprisingly, by simply cutting and shaping the graphene sheet into unusual configurations, from ladder-like linear arrays of contacts, to narrowly constricted rectangles, to tapered and terraced edges."

In most solar energy harvesting devices, a photocurrent arises only in the presence of a junction between two dissimilar materials, such as *p-n* junctions. The electrical current is generated in the junction region and moves through the distinct regions of the two materials. In the pristine graphene, the photocurrent emerged near the edges and corners of the material.

In principle, graphene can absorb light at any frequency, making it suitable for IR and other types of photodetection. The discovery that pristine graphene can convert light into electricity efficiently could lead to more efficient, faster photodetectors, and potentially more efficient solar panels.

The researchers have found evidence that the use of pristine graphene to generate photocurrent engenders a greatly enhanced photoresponse in the IR regime and results in ultrafast operation speeds. “We plan to further study this effect in a broad range of IR and other frequencies, and measure its response speed,” said researcher Qiong Ma from the Massachusetts Institute of Technology.

For more information:
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