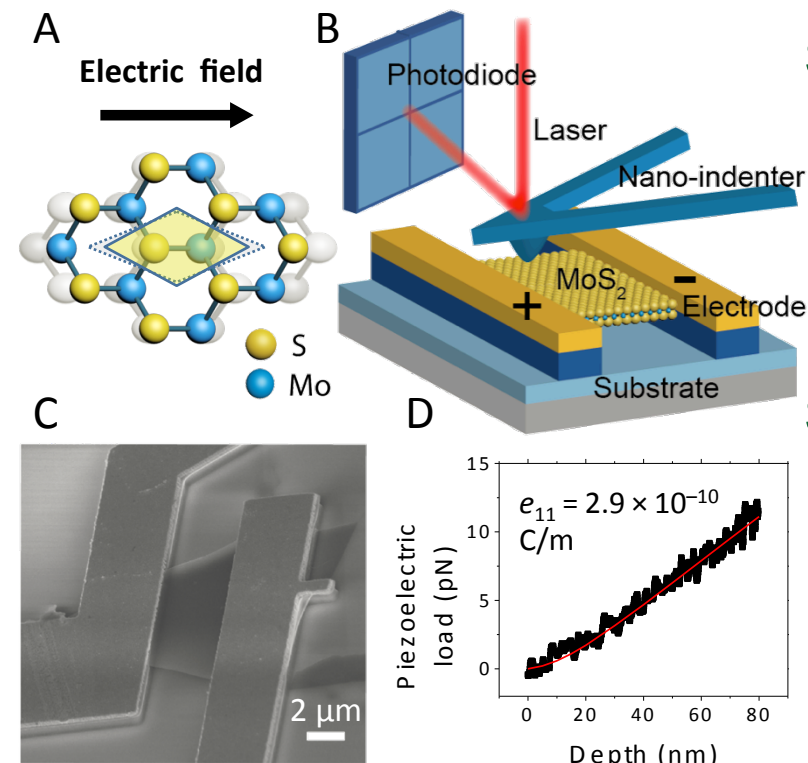


# First free-standing 2D piezoelectric material experimentally demonstrated with MoS<sub>2</sub>



## Scientific Achievement

We experimentally observed robust piezoelectricity in suspended single molecular layer of MoS<sub>2</sub> in atmosphere, the first discovery of such direct conversion between electricity and mechanical stress in free-standing 2D materials.

## Significance and Impact

It promises new applications in nano-generators and low-power logic switches for computing scaled down to a single atomic unit cell.

## Research Details

- Fabricated electro-mechanical devices with free-standing single-layer MoS<sub>2</sub> membrane and measured its piezoelectric coefficient by nano-indentation.
- Characterized the piezoelectric responses of MoS<sub>2</sub> at various orientations and numbers of layers that reveal the underlying crystalline symmetry.

Hanyu Zhu, Yuan Wang, Jun Xiao, Ming Liu, Shaomin Xiong, Zi Jing Wong, Ziliang Ye, Yu Ye, Xiaobo Yin, Xiang Zhang, Nature Nanotechnology (2014) AOP

- A) MoS<sub>2</sub> crystal deforms under electric field.
- B) The piezoelectric stress is measured by deflection of a nano-indenter.
- C) The fabricated free-standing MoS<sub>2</sub> device.
- D) The piezoelectric coefficient is calculated from the force-indentation slope.

Work was performed at Lawrence Berkeley National Lab