Mixed-cation perovskite solar cells in space

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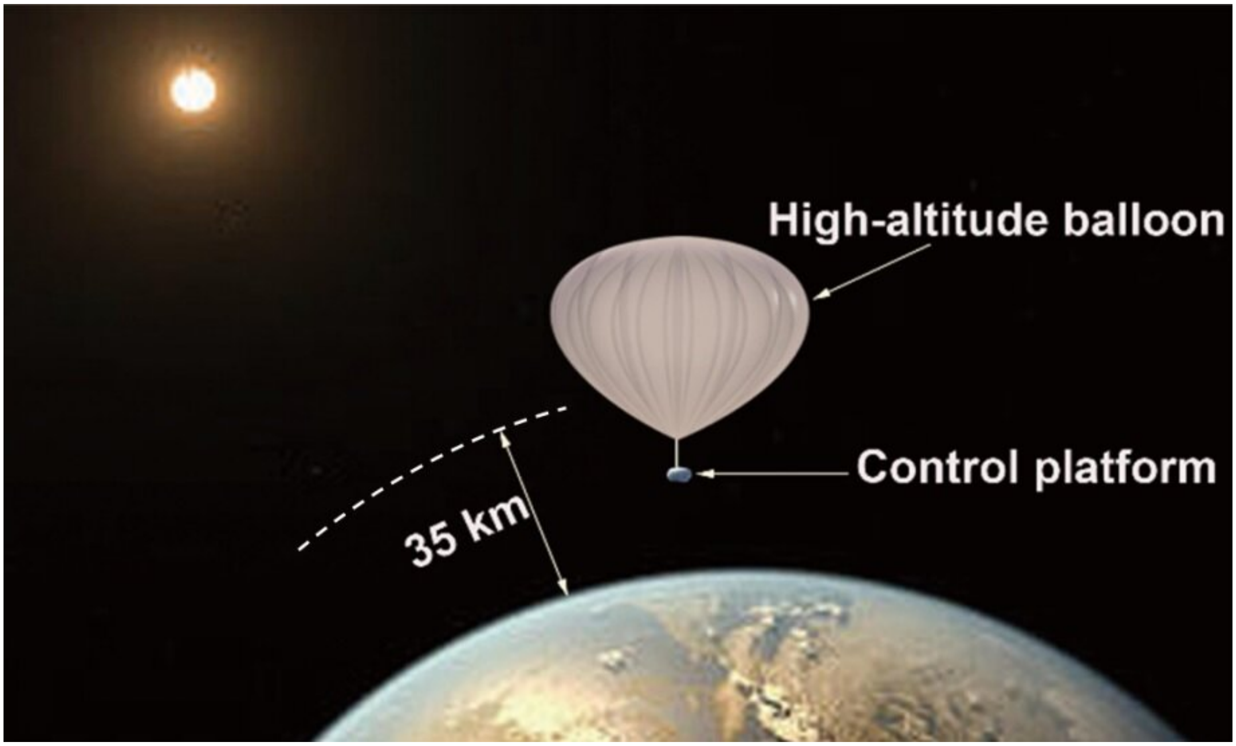

Representative schematic of the high-altitude balloon in near space (perovskite solar cells were fixed on the control platform). Credit: Science China Press

With the continuous improvement of efficiency and stability, perovskite solar cells are gradually approaching practical applications. PSCs may show the special application in space where oxygen and moisture (two major stressors for stability) barely exist. Publishing in *Sci. China-Phys. Mech. Astron.*, a group of researchers at Peking University in China, led by Dr. Rui Zhu and Prof. Qihuang Gong in collaboration with Prof. Guoning Xu from Academy of Opto-Electronics, CAS, and Prof. Wei Huang from Northwestern Polytechnical University, have reported the stability study of PSCs in near space.

Metal halide perovskite materials demonstrate outstanding performance in photovoltaics because of their excellent optoelectronic properties. PSCs exhibiting outstanding efficiency, high power per weight, and excellent radiation resistance are considered to be promising for developing new-generation energy technology for space application. However, the extreme space environment would impose a considerable challenge to the stability of devices, while the application of PSCs in space has rarely been researched.

Researchers demonstrated an attempt for a stability study of large-area perovskite solar cells (active area of 1.00 cm^2) in near space. The devices were fixed on a high-altitude balloon rising from ground to near space at an altitude of 35 km in the Inner Mongolian area of China. The near space atmosphere at 35 km contains trace amount of both moisture and ozone, resulting in AM0 solar spectrum with the light intensity of 136.7 mW/cm2. This atmosphere also contains high-energy particles and radiation (such as neutrons, electrons, and gamma rays), originating from the galactic cosmic rays and solar flares.

The devices were fabricated as a TiO_2 mesoporous structure based on two commonly reported mixed-cation perovskites, $FA_{0.9}Cs_{0.1}PbI_3$, and $FA_{0.81}MA_{0.10}Cs_{0.04}PbI_{2.55}Br_{0.40}$. Moreover, different kinds of perovskite photoactive absorbers with and without UV filter were investigated. As a result, the device based on $FA_{0.81}MA_{0.10}Cs_{0.04}PbI_{2.55}Br_{0.40}$ retained 95.19 percent of its initial power conversion efficiency during the test under AM0 illumination.

Researchers anticipate that this study will contribute to the future research into stable perovskite solar cells. This work also opens the route for perovskite solar cells in future space applications. Dr. Rui Zhu and his colleagues are continuing to push the practical application of perovskite solar cells in space.

More information: YongGuang Tu et al, Mixed-cation perovskite solar cells in space, *Science China Physics, Mechanics & Astronomy* (2019). DOI: 10.1007/s11433-019-9356-1

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