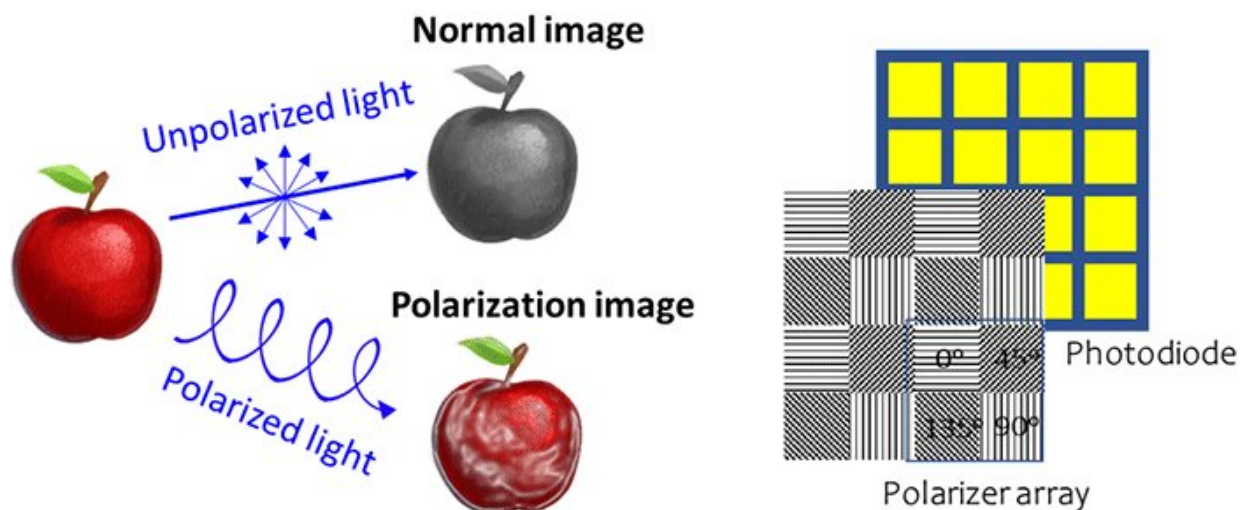


Highly sensitive detection of circularly polarized light without a filter

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Visualized images obtained by detection of polarized light and conventional polarization image sensor. Credit: Japan Science and Technology Agency

Under JST Strategic Basic Research Programs, PRESTO researcher Ayumi Ishii, (Toin University of Yokohama, specially appointed lecturer) has developed a photodiode using a crystalline film composed of lead perovskite compounds with organic chiral molecules to detect circularly polarized light without a filter.

A technology to detect '[polarization](#),' or oscillation direction of [light](#) can visualize object surfaces with damages, foreign objects, and distortions.

Furthermore, detection of circularly polarized light, or rotating electric field of light makes it possible for us to identify stress intensity and distribution of objects. Conventional photodiodes for camera or sensor applications cannot detect polarization of light directly, and therefore, various types of filters must be attached on top of the device to separate the information of polarization spatially. These structures cause substantial losses of sensitivity and resolution in the light detection, especially detection of circularly polarized light is heretofore considered difficult. Thus, it has been much desired to develop a new sensor for detection of circularly polarized light without any filters.

In the present study, Dr. Ishii prepared an organic-inorganic hybrid chiral crystalline film consisting of lead perovskite compounds and [organic molecules](#) with chirality, which cannot be superposed on its mirror image like right and left hands. This study exhibited that the hybrid film forms a helical one-dimensional (1D) chain structure and the spiral direction allows for selective absorption of left or right-handed circularly polarized light. The photodiode based on this 1D chiral crystalline film successfully detected rotational direction of circularly polarized light without a filter. The ratio of sensitivities between left- and right-handed circularly polarized light detections achieved the world's highest value of 25 or higher for a filterless circular polarization detector.

Direct detection of circularly polarized light without a filter as shown in the present result allows for higher sensitivity and miniaturization of photodetectors. It is anticipated to become a new sensor technology that would achieve acquisition of a previously unidentified information and recognition of stress.

More information: A. Ishii et al, Direct detection of circular polarized light in helical 1D perovskite-based photodiode, *Science Advances* (2020). [DOI: 10.1126/sciadv.abd3274](https://doi.org/10.1126/sciadv.abd3274)

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