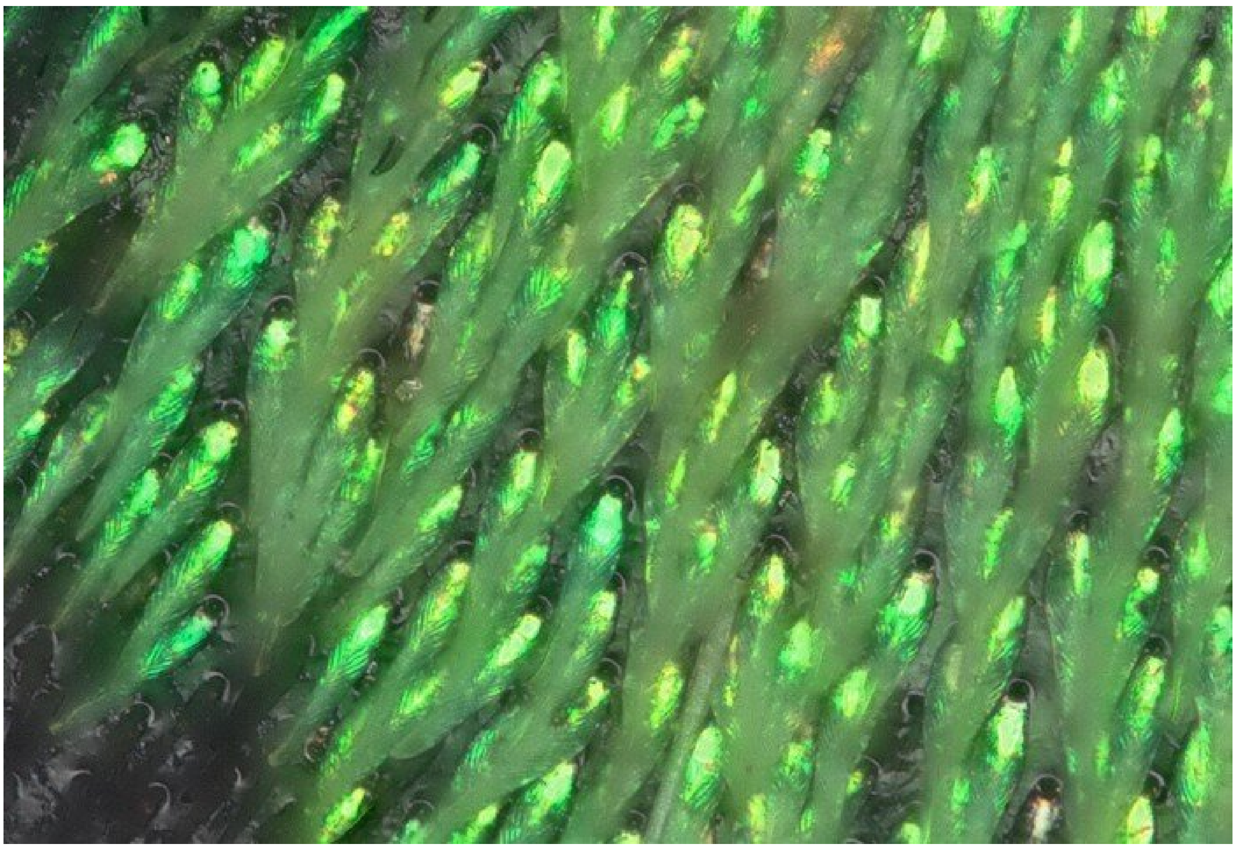
New type of photonic crystal structure found in longhorn beetle

November 11 2021, by Bob Yirka



The scales of an African beetle species contain crystalline structures that color the insect a brilliant green. Credit: DOI: 10.1098/rsif.2021.0505

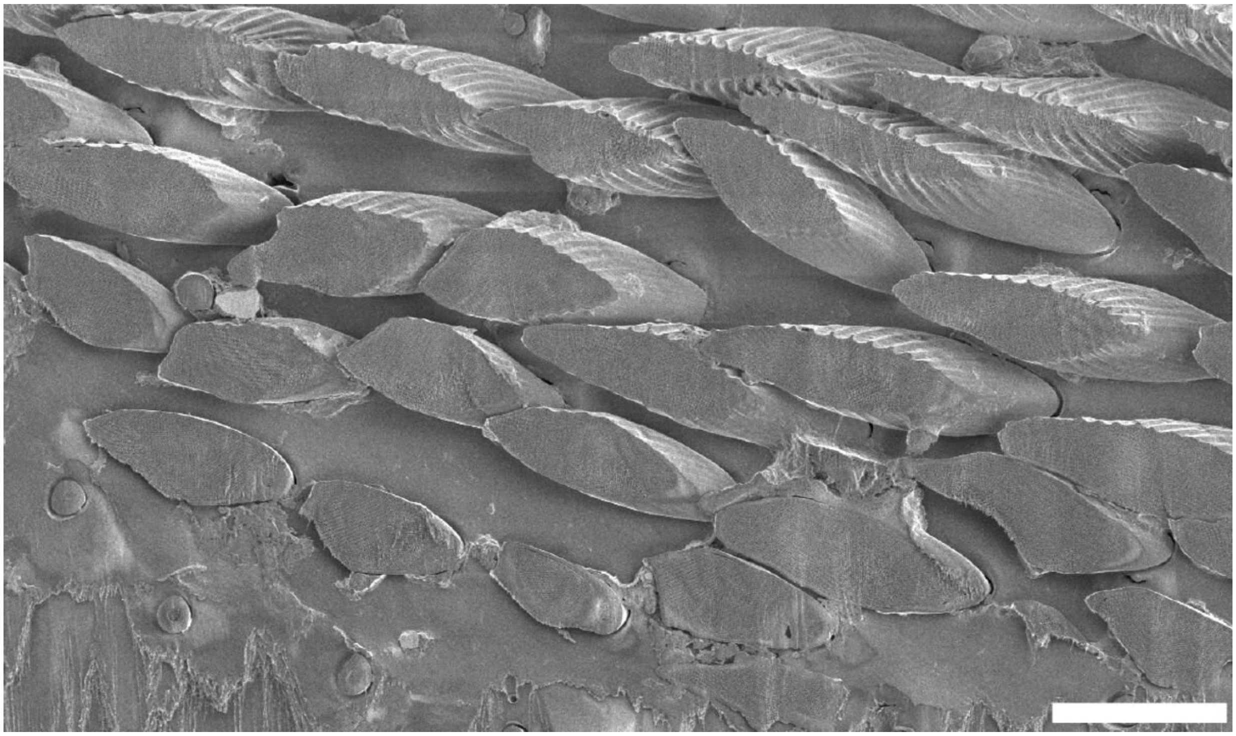
A trio of researchers at Tokyo University reports evidence of a new type of photonic crystal structure in the scales of a longhorn beetle. Yuka

Kobayashi, Ryosuke Ohnuki and Shinya Yoshioka have published their report in the *Journal of the Royal Society Interface*.

Photonic crystals are periodically structured; they typically have a band gap. Light cannot propagate through such crystals, and they can thus serve as a form of optical insulator. Because of their periodicity, the crystals impact the path of photons similarly to the way electrons are impacted by ionic lattices. They also appear quite often in nature, impacting coloring of fauna such as butterflies by reflecting light in different ways. In this new effort, the researchers have found a new kind of photonic crystal structure in longhorn beetles.

Longhorn beetles are found in many parts of the world and are known for their extremely long antennae—in some cases, they grow to be longer than the body of the beetle. The longhorns under study in this new effort were of a species found in Africa that are known for their bright green hues. To learn more about the coloring of the beetles, the researchers captured specimens and studied the green scales that cover their bodies. In so doing, they discovered a crystalline structure.

The previously unknown structure was an I-WP minimal-surface-based photonic crystal. They found it to have an unbalanced surface and it had dual subspaces that were separated by surface material—the crystal pairs were also not of the same shape or size. They also found that crystals adjacent to one another shared a single crystal plane, which served as a domain boundary. The researchers suggest this last finding indicates that the crystals developed initially as twins. The findings suggest that there is more to learn about the ways that photonic crystals can develop in natural settings.



SEM images of the cross section of the elytrum. Scale bar: (a) 20 um and (b) 5 um. Credit: *Journal of The Royal Society Interface* (2021). DOI: 10.1098/rsif.2021.0505

More information: Yuka Kobayashi et al, Discovery of I-WP minimal-surface-based photonic crystal in the scale of a longhorn beetle, *Journal of The Royal Society Interface* (2021). DOI: 10.1098/rsif.2021.0505