material on its own. More recently it was demonstrated that h-BN could enable imaging of deeply subdiffractional objects and to offer nanoscale focal spots in its natural form[3,4]. These results demonstrate the potential for imaging soft matter of very small objects using low-energy infrared light, and demonstrate the first efforts towards h-BN-enabled nanophotonic devices. Subsequent work may focus on the development of h-BN-based designs for nanoscale infrared detectors[4], quantum nanophotonics[6] and perhaps even optical logic circuits[4]. Furthermore, the functionality of h-BN may be extended through the formation of heterostructures with other van der Waals or III-nitride crystals. For instance, HPs in graphene/h-BN heterostructures have been shown to gain an increased bandwidth and tunability via gating, while retaining the hyperbolic behaviour[13,14]. This has also led to theoretical discussions that such electromagnetic hybrids can result in enhanced and gate-tunable Purcell factors[8], with potential applications in trace-level molecular sensing of infrared-active vibrational bands. As such, this promises a wealth of advanced infrared optic designs and devices in the coming years. Measurements such as those reported by Yoxall and co-authors enable the necessary characterization and visualization of the polaritonic properties that will allow such designs and devices to come to fruition. ❐

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VISION OPTICS

The eyes have it

Human pupils are round; the shape of animal pupils varies. Goats, sheep, horses, domestic cats and many other animals have pupils that change from being fully circular in dim light to narrow slits or rectangles in bright light. The hypothesis is that elongated pupils allow greater control over the amount of light entering the eye. Take a domestic cat: its pupil area can change by a factor of 135 from fully dilated to fully constricted, whereas the round human pupil can only change area by a factor of 15. Pupil dilation and constriction are very useful for animals that are active both day and night, allowing for much better vision in low-light conditions. However, this hypothesis doesn't explain why the pupils are orientated to be vertical in some species and horizontal in others.

Have you ever wondered why foxes and domestic cats, for example, have vertically elongated pupils, in contrast to sheep, horses and deer, which have horizontally elongated ones? If the only reason for elongated pupils was to control the amount of light entering the eye the orientation would not be important.

A recent study reported by Martin Banks and colleagues from the University of California, Berkeley in the USA and Durham University in the UK quantitatively reveals the physics behind

GORDON LOVE

the different pupil shapes in animals (*Sci. Adv.* **1,** e1500391; 2015). Their work focuses on the visual benefits of vertical and horizontal pupils in mammals and snakes.

"There are three main findings in this work," said Gordon Love from Durham University. First, there is a strong correlation between whether the animal is prey or predator, the kind of predator (characterized by the time of day active), and the shape of the pupil. "This has been discussed before but we document the relationship statistically. The horizontally elongated pupil is very likely to occur in prey animals with the eyes on the sides of their head, whereas the vertically elongated pupil is likely to occur in ambush predators that are active during day and night," explained Love. Second, the horizontally elongated pupil aids vision panoramically across the ground to aid detection of approaching predators and running across uneven terrain. Third, the vertically elongated pupil aids depth perception by allowing stereopsis and blur to work in a more complementary fashion than would otherwise be the case.

"The hypothesis for horizontal pupils has been described before, but never quantified. Here, we show that the idea is valid by constructing a model eye based on the domestic sheep and examining what happens when the pupil is elongated along different axes or not elongated," said Love. "The hypothesis for vertical pupils is novel. Again we show that the idea is valid by constructing a model eye and examining how pupil orientation affects the amount of blur in the retinal image."

"This is classic pure science, trying to understand how nature works!" Love told *Nature Photonics*. There are still some unexplained pupils in nature. Understanding all of the variations is an interesting challenge for the future.

RACHEL WON