numerical simulations of the trajectories of antihydrogen atoms to help understand the formation and trapping processes in more detail. The results are consistent with antihydrogen atoms in thermal equilibrium at the temperature of the positrons from which they were formed.

So why now and not earlier? Experimenters have become much more adept over the years in creating, cooling and compressing antiproton and positron plasmas. Furthermore, the ALPHA collaboration used a novel auto-resonance technique to combine the antiprotons and positrons. This technique forces the antiprotons through the positron plasma very gently, creating colder, more trappable antihydrogen atoms. Less is also better: the experiments use relatively small clouds of antiprotons (10^4) and positron plasmas (10^6) to minimize the effects of unwanted electric fields. Both species are evaporatively cooled before mixing.

Still, there is enormous room for improvement. Only one atom is formed in every two mixing cycles, and the positron (and thus the antihydrogen) temperature is 80 times the atom-trap well depth. Learning how to create lower-energy antihydrogen atoms would be a huge advance. This might be done by further refining the present scheme, or perhaps by using another antihydrogen production scheme altogether (for example, collisions of high-Rydberg-state positronium atoms with antiprotons)[6].

Another consideration is the octupole magnetic field of the ALPHA minimum-**B** atom trap. Although probably critical for anti-atom creation, it has a broad potential minimum for the anti-atoms. Some precision measurements require atoms that are localized on the magnetic axis, so perhaps an octupole trap for antihydrogen formation and initial trapping, and a quadrupole trap for long-term studies will turn out to be preferable.

In the broader picture, this paper marks great progress in the quest to compare with precision the properties of antihydrogen with that of its ordinary matter cousin. However, there may well be more twists in the road before this immensely challenging goal is achieved. ❐

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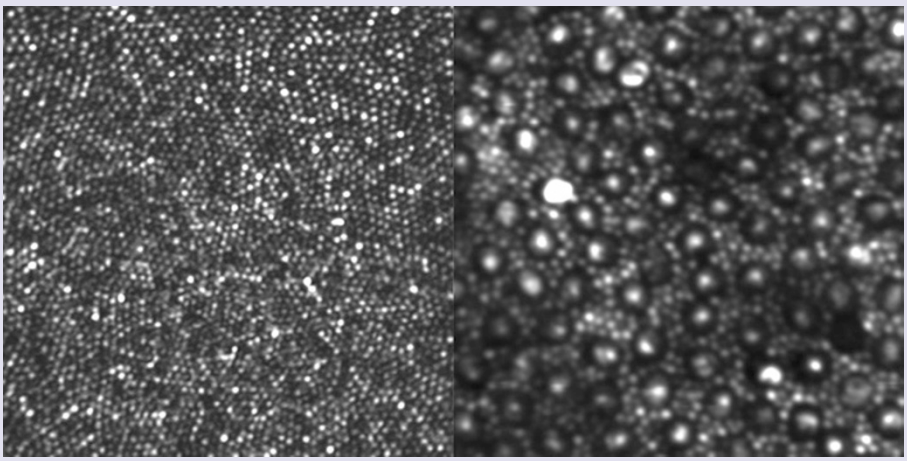
ADAPTIVE OPTICS

Retinal rods resolved

Although cone cells are more important for everyday vision, rod cells make up the vast majority (approximately 95%) of the photoreceptors of the human eye. Rods are much more sensitive than cones. So sensitive, in fact, that they are able to respond to individual photons, giving us the ability to see in low-light conditions. And they are responsible for detecting movement in our peripheral vision.

But, owing to their small size (around 2 μm in diameter) and the optical distortions introduced by other components of the eye, resolving individual rod cells in living eyes using conventional medical imaging techniques is practically impossible. This makes it difficult to diagnose the early stages of disease in these cells in order to treat them and prevent irreversible damage.

However, Alfredo Dubra and colleagues have now developed a microscope that is able to collect detailed images of the mosaic of photoreceptors in the retinas of living subjects (*Biomed. Opt. Express* **2,** 1864–1876; 2011 and *Biomed. Opt. Express* **2,** 1757–1768; 2011). It relies on a technique known as adaptive optics, pioneered by astronomers to correct for distortions introduced by the atmosphere and produce sharp images of the heavens using Earth-bound telescopes.



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Their microscope — known as a confocal adaptive-optics scanning ophthalmascope — works in three stages: scanning a focused beam of light across the subject's retina; measuring variations in the wavefront of the reflected light, which are introduced by imperfections in the lens and cornea at the front of the eye, and then correcting for these perturbations with deformable mirrors. The result is retinal images with resolutions approaching the diffraction limit for the wavelengths of light used. Both the small cones at the centre of the retina (pictured left) and the small rods surrounding larger cones at the retina's periphery (pictured right) are clearly resolved.

Dubra *et al.* expect that this ability to routinely collect detailed images of retinal structures in a clinical setting will make it possible to diagnose retinal disease earlier, and to generate a wealth of previously inaccessible data for the development of better treatments.

ED GERSTNER

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