THIS WEEK

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Earthrise at 50

An iconic photo of Earth from the Moon was taken by Apollo 8 astronaut William Anders in December 1968. It inspired people then, and can do so again.

It takes an eye for a certain type of detail to look at a photo of the bejewelled Earth hanging in the sky over the sterile terrain of the Moon and see, not the fragility of humanity's only home, but a barren lunar crater. But look carefully and it's there. And now that crater has a new name: Anders' Earthrise.

The Working Group for Planetary System Nomenclature of the International Astronomical Union (IAU) approved the naming of the crater — and another nearby, called 8 Homeward — to mark the 50th anniversary of the Apollo 8 mission that orbited the Moon, and more specifically, the famous photograph taken from on board of Earth rising over the lunar surface. Snapped on 24 December 1968 by astronaut William Anders, *Earthrise* is often labelled as one of the most important and influential photographs in science, if not all of human history.

Needless to say, the status of the image is not down to the circular dent captured in one corner. Instead, it's because the photograph — which seems to show Earth rising above the Moon's horizon — has been credited with starting the environmental movement. Readers of Rachel Carson's book *Silent Spring* — which highlighted the damaging impacts of pesticides on the natural world six years earlier — might argue with that common trope. But it's undeniable that *Earthrise* was profoundly important in raising awareness and focusing minds. For the first time, people could see their planet framed against the black emptiness of eternal space and appreciate its technicolour beauty as well as its utter insignificance in the Universe.

> ***"We do not have to be passive observers, trapped by the scale and magnitude of the Universe."***

An entire generation suddenly saw the planet as isolated and vulnerable, and very difficult to replace. (A later generation would experience this for themselves, with the publication of another iconic picture of the planet: the *Pale Blue Dot*, taken from a distance of 6 billion kilometres by the Voyager 1 probe on St Valentine's Day in 1990.)

The view of Earth from space is much the same now as it was then. (Just witness the stunning images released earlier this year from the GOES-16 satellite, which show the planet in extraordinary detail.) But how we think about such images has drastically changed.

For many millions of people, the end of 2018 sees a better, more prosperous world than the one the Apollo 8 astronauts returned home to 50 years ago. Human progress, driven by advances in science, medicine and technology, has radically improved average living standards, health and life expectancy. But Earth itself is panting to keep up. Only two months ago, the Intergovernmental Panel on Climate Change issued its most urgent warning yet about the effects of climate change, warning that a temperature rise of even 1.5 °C — which most experts agree is inevitable — will bring devastating droughts and floods.

It's likely to be much worse than that, however. Last week, the world's politicians met in Poland to discuss next steps on a global climate agreement that could be the last, best hope to stem climate change. The deal will make insufficient change to the amounts of damaging greenhouse-gas emissions we hurl into the atmosphere.

Powerful images show what is at stake. But they also show what we can still achieve: that we do not have to be passive observers, trapped by the scale and magnitude of the Universe and its problems. We can act. We can make things happen.

Take *Earthrise*, the picture and the phenomenon. We did that. The Moon is tidally locked to Earth and that fixes the planet's position in the lunar sky. Earth doesn't rise from the Moon and only seemed to do so for the Apollo 8 astronauts because their craft was speeding above the surface, gradually revealing more of Earth as it travelled. Even as the planet hung there in the blackness of infinity, the people who saw it were moving forwards. We still can. ■

Fur and fossils

Feather-like structures on pterosaurs open up a world of colour.

Pterosaurs are the first known vertebrate group to have evolved powered flight — preceding birds and bats by many millions of years. Ranging from the size of small birds to that of small planes, pterosaurs lived alongside the dinosaurs and went extinct at the same time. Many things about these creatures remain mysterious, not least their origin — the earliest pterosaur fossils found so far seem to have been fully capable of flight, and there is no confirmed transitional fossil to show from which reptilian group they emerged.

This is different from, say, birds. Revelations over the past two decades that bird-like feathers were present on dinosaurs — ground dwelling and with the flight capability of a sack of spanners — have illuminated our understanding of the evolution of birds and their characteristic structures.

That the bodies of at least some pterosaurs were clothed with a kind of fuzz has been known (or at least suspected) since the 1830s, but this fluffiness became a focus of study only after the description of the exceptionally hirsute Kazakh pterosaur *Sordes pilosus* in 1971.

Pterosaur fluff, comprised of what are technically known as 'pycnofibres', is structurally different from mammalian fur or hair. Each pycnofibre is a short, simple filament with a canal running down the centre, and is much more superficially attached than the deeply rooted hairs of mammals. Pycnofibres have been observed on the heads, limbs and bodies of several pterosaur fossils.

Ironically, given that they could fly, discussion of feathers and