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# Science Focus

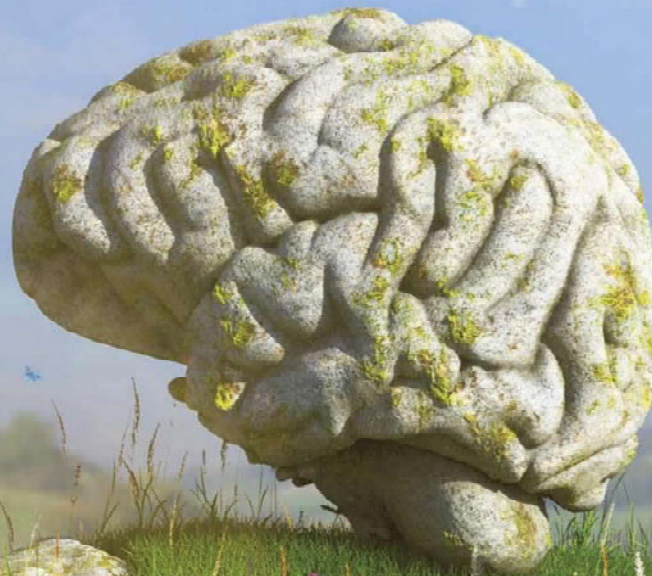
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### BITUMEN ADDS TO AIR POLLUTION IN TOWNS

Bitumen found in roads, roof and driveways is a significant source of air pollution in urban areas, particularly on sunny days, a study by researchers at Yale University has found. They found that when heated, fresh bitumen released a complex mixture of compounds, including many hazardous pollutants. They say that these can lead to secondary organic aerosol (SOA), a major

contributor of PM<sub>2.5</sub> – a type of particulate air pollution comprising particles smaller than 2.5 micrometres in diameter, which has substantial public health effects. The researchers also examined what happens when bitumen is exposed to solar radiation and saw a significant jump in emissions – up to 300 per cent for road bitumen – demonstrating that solar radiation, and not only temperature, can lead to an increase in emissions.

## SPACE

# Andromeda Galaxy has a humongous halo of gas

Astronomers using the Hubble Space Telescope have mapped the enormous halo of gas surrounding the Andromeda Galaxy – the closest large galaxy to our Milky Way.

The map, which is the most detailed of its kind, shows that the halo of plasma (electrically charged gas) surrounding this spiral galaxy extends about 1.3 million light-years towards the Milky Way (about half of the distance), and as much as two million light-years in some directions.

The halo is invisible, but the researchers say that if it could be seen, it'd be about three times the width of the Plough, making it the biggest feature in the night sky.

“Understanding the huge halos of gas surrounding galaxies is immensely important,” said team member Samantha Berek at Yale University. “This reservoir of gas contains fuel for future star formation within the galaxy, as well as outflows from events such as supernovae. It's full of clues regarding the past and future evolution of the galaxy, and we're finally able to study it in great detail in our closest galactic neighbour.”

The team found that Andromeda's halo is composed of two distinct layers. The inner ‘shell’ has a more complex structure than the outer shell, which is likely the result of supernovae in the galaxy's disc. These violent explosions – the death throes of giant stars – also eject heavy elements into space, which were detected in high amounts in the halo.

The halo was mapped by studying the ultraviolet light from 43 distant quasars –

extremely luminous galactic cores that are powered by black holes – located behind the halo. The researchers used Hubble's Cosmic Origins Spectrograph instrument to analyse how this background light was absorbed by the halo's gas in different regions, revealing variations in the gas's structure.

Andromeda is thought to be similar in size and shape to our Milky Way, so these findings also provide insights into our own galactic halo, which is much trickier to map from our position inside the Milky Way.

The gaseous halo surrounding the Andromeda Galaxy, if it could be seen with the naked eye

