

Every villain has an origin story, and medulloblastoma is no exception. Let's hope that these developments will lead to heroic success in providing clinical benefits.

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Astronomy

Outer regions of galaxy clusters host megahaloes

Kenda Knowles

Observations reveal the presence of large volumes of ionized gas surrounding four galaxy clusters. The properties of these 'megahaloes' are distinct from those of similar haloes near the clusters, implying different formation mechanisms. **See p.911**

Radio haloes are large sources of radio-frequency emission that are found at the centre of galaxy clusters. They are thought to be produced when electrons travelling at speeds comparable to that of light are accelerated by magnetic fields in the turbulence that arises when the clusters merge. The detection of haloes spanning areas of around one square megaparsec has grown substantially over the past decade¹, thanks in part to the increased sensitivity of the present generation of telescopes. But now, on page 911, Cuciti *et al.*² report large volumes of faint, diffuse radio emission – on a much larger scale – surrounding four known radio haloes. The findings suggest that electron-acceleration mechanisms occur much farther out in the cluster region than had been previously thought.

Synchrotron emission is the electromagnetic radiation that is produced when 'relativistic' charged particles (such as electrons moving at light speeds) are accelerated by magnetic fields (such as those in galaxy clusters). The electrons lose energy as they travel through the magnetic field, which means that there is a limited time in which their synchrotron emission can occur. This time, in turn, constrains the distances over which emission should be detected. So emission over longer distances signals the existence of some mechanism through which energy is distributed to the electrons that allows them to maintain their relativistic speeds. Synchrotron emission is referred to as the non-thermal component of the radiation observed in cluster radio haloes, to distinguish it from the thermal emission that emanates from the hot gas.

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From the archive

An ancient mystery about poisonous honey solved, and the rise of photography to document museum collections.

100 years ago

In the September issue of *Discovery*, Prof. W. R. Halliday, with the help of his colleague, Prof. McLean Thompson, has cleared up a difficulty unsolved by editors of Xenophon's "Anabasis." The historian describes how the retreating Greeks, when they arrived near Trebizond, ate some honey, with effects ranging from intoxication to insensibility. Some authorities have denied that poisonous honey was found ... but the writers now point out that there is no evidence to show that the breed of bees ... or the general climatic condition, was responsible ... When honey is produced in excess, and the floral parts fail to develop, there results an accumulation of by-products in which toxins abound. When the competition for nectar pollen is intense many insects develop a biting habit, piercing the tissues of plants in search of short-cuts to food supply, and this habit results in the formation of poisoned honey. The observation of Pliny that honey was poisonous in some seasons and not in others is thus proved to be accurate, and can be explained on scientific grounds.

From Nature 30 September 1922

150 years ago

Photographs from the Collections of the British Museum. Taken by S. Thompson — Among all the varied purposes to which the art of photography has been applied, there is perhaps none for which it has proved itself more valuable than for the reproduction of ancient works of art ... [T]he reproduction by the camera ... will give a more vivid and faithful idea of the original than any drawing by however skilful an artist ... It is with great satisfaction, therefore, that we see this series of nearly a thousand quarto photographs of objects in our national collections ... We ... hope that each local museum will have its objects photographed and ... made accessible to the public at a fixed moderate cost.

From Nature 26 September 1872



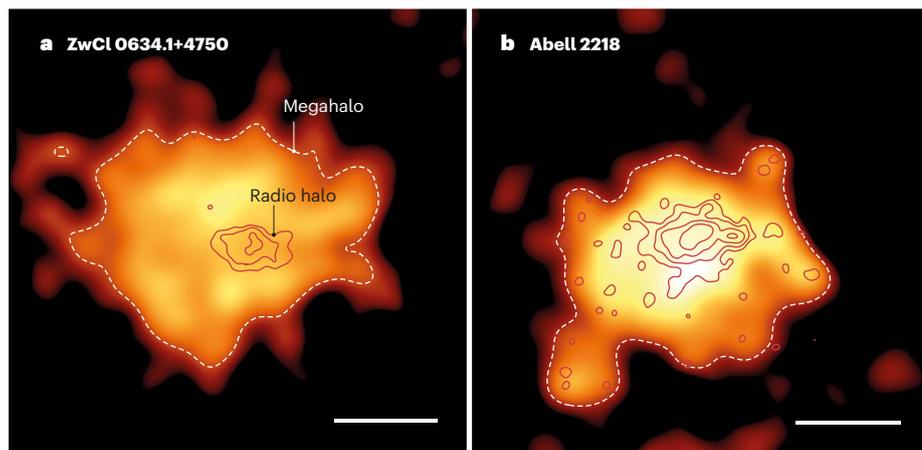


Figure 1 | A megahalo surrounding a galaxy cluster. Radio haloes are large volumes of ionized gas emitting radio-frequency radiation, and are found at the centre of galaxy clusters. In their survey of 310 galaxy clusters, Cuciti *et al.*² identified 4 clusters that had similar radio-emitting material far from the centre, in the outer regions of the clusters. The authors termed these sources megahaloes, and found evidence to suggest that their formation mechanism differs from that of typical radio haloes. Two of the four clusters are shown here: **a**, ZwCl 0634.1+4750; **b**, Abell 2218. Scale bars, 1 megaparsec. (Adapted from Fig. 1 of ref. 2.)

authors dubbed these haloes megahaloes, and noted that they had a much lower brightness profile and emissivity than do typical radio haloes (Fig. 1). These observations led them to conclude that, although the megahaloes are related to regular haloes, the two types of entity are distinct, and might therefore be formed by slightly different mechanisms.

Although Cuciti and colleagues' sample size is small, their findings show that relativistic particles and magnetic fields are present in a greater extent of a cluster than was previously thought. All four of the authors' clusters are characterized by high mass and low redshift, a measure of the change in emission wavelength that reveals how far the cluster is from Earth. That they all fall into this category prompted the authors to conclude that the mass of the cluster is related to the power of the megahalo, just as it is for conventional radio haloes. Whether this means that synchrotron emission is not generated on the outskirts of lower-mass clusters is perhaps a question that can be answered only once the SKA is fully up and running – it could simply be too faint to be detected with current instruments.

It is noteworthy that megahaloes were not observed in nine other clusters that met the same mass–redshift criteria as the four reported by Cuciti and colleagues. The authors reason that the data quality was too poor, or radio signals in the region too complex, to enable the observation of megahaloes around these nine clusters. Both issues could indeed hamper extraction of the large-scale faint emission from observations. However, the authors do not discuss whether the upper limits of megahalo detection in these systems are at odds with the rest of their observations.

The dynamic nature of the systems might also be a factor in the difficulty of observing megahaloes around low-mass

clusters producing limited synchrotron power. Simulations have shown that not all galaxy-cluster mergers are created equal, and that the point at which the system is observed during a merger can also markedly affect the observable characteristics of diffuse emission⁸. Whether this is part of the reason that likely candidate clusters were not observed to have megahaloes is still to be investigated.

Cuciti *et al.* also used hydrodynamic cosmological simulations to probe the amount of energy produced by turbulence in different parts of clusters. Intriguingly, they found that the amount of turbulent energy in volumes

that were commensurate with their observed megahaloes was similar in clusters that were undergoing merger activity and those that were not. This could indicate that the formation mechanisms for megahaloes do not rely on turbulence generated by mergers, and are therefore different from those driving the radio haloes embedded in clusters.

At this stage, the discovery of these megahalo sources poses more questions than it answers. But it opens up an exciting avenue for cluster studies at low emission frequencies, and offers further evidence of the scientific discoveries that lie waiting as our telescopes become more powerful and our data-processing techniques more advanced than ever before.

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Palaeontology

Lifting the veil on the oldest-known animals

Marc Laflamme

Gaps in the fossil record mean that the origins of ancient animals such as jellyfish and corals have remained a mystery. Now, a long-awaited fossil discovery reveals key features of this group during the early stages of its evolution.

Jellyfish and corals belong to the group of animals known as cnidarians. The oldest-known ancestors of this grouping are thought to have arisen by the Ediacaran period (between 635 million and 539 million years ago); however, fossil examples of cnidarians have been lacking. Writing in *Nature Ecology & Evolution*, Dunn *et al.*¹ report the discovery of a fossil cnidarian from Charnwood Forest in

the United Kingdom. If this attribution is correct, the species – which the authors named *Auroralumina attenboroughii*, in honour of the natural historian David Attenborough – has a body plan that is very different from that of other Ediacaran organisms. Its architecture is instead much more reminiscent of younger forms derived from a subsequent event called the Cambrian explosion, which underpinned