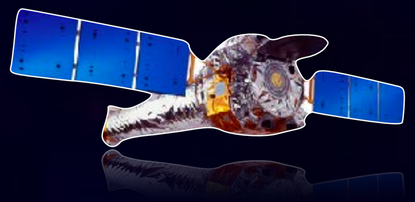
Blackhole activity is not evolving in central cluster galaxies



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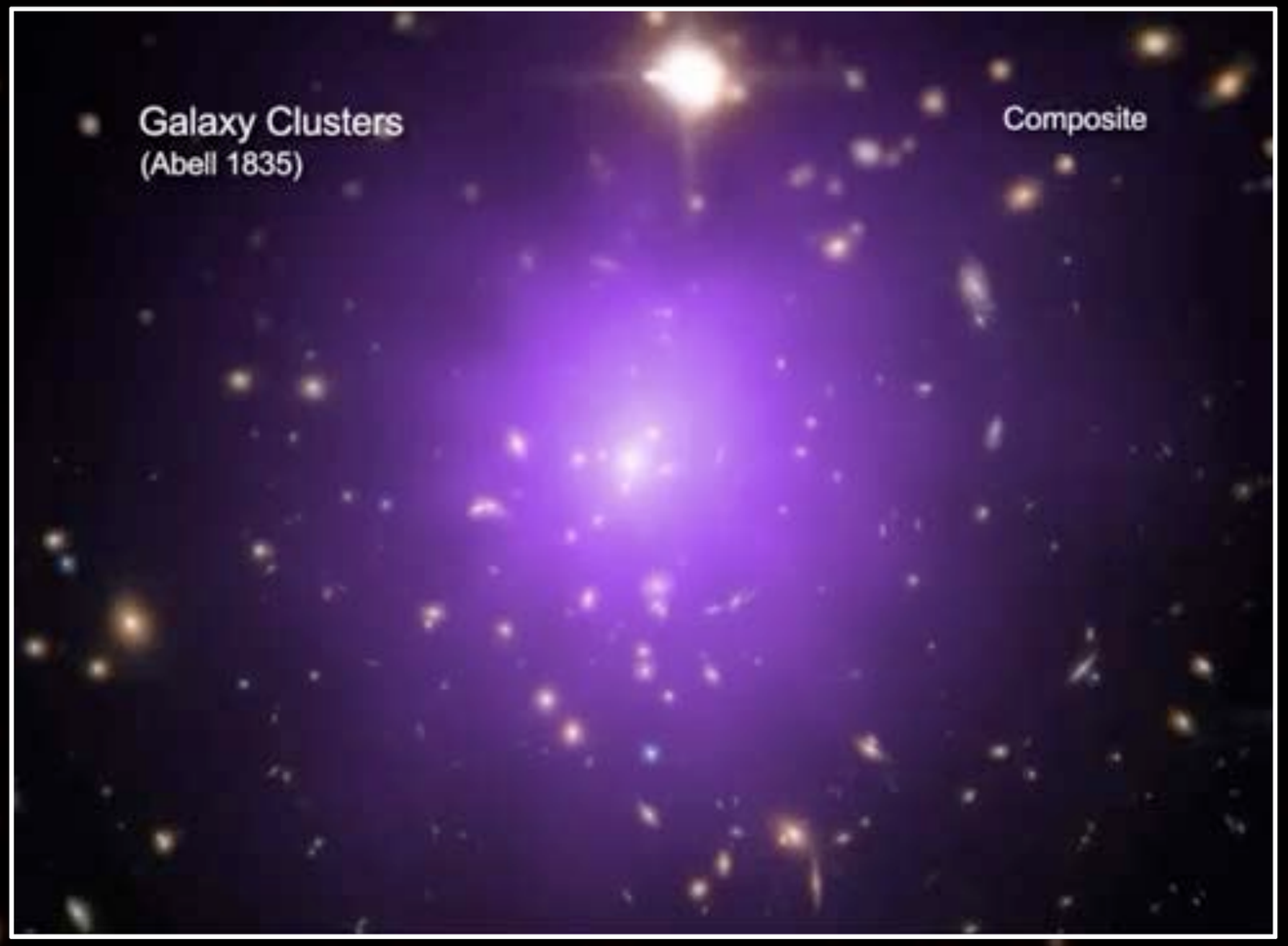
Galaxy clusters are the most massive systems in the Universe!



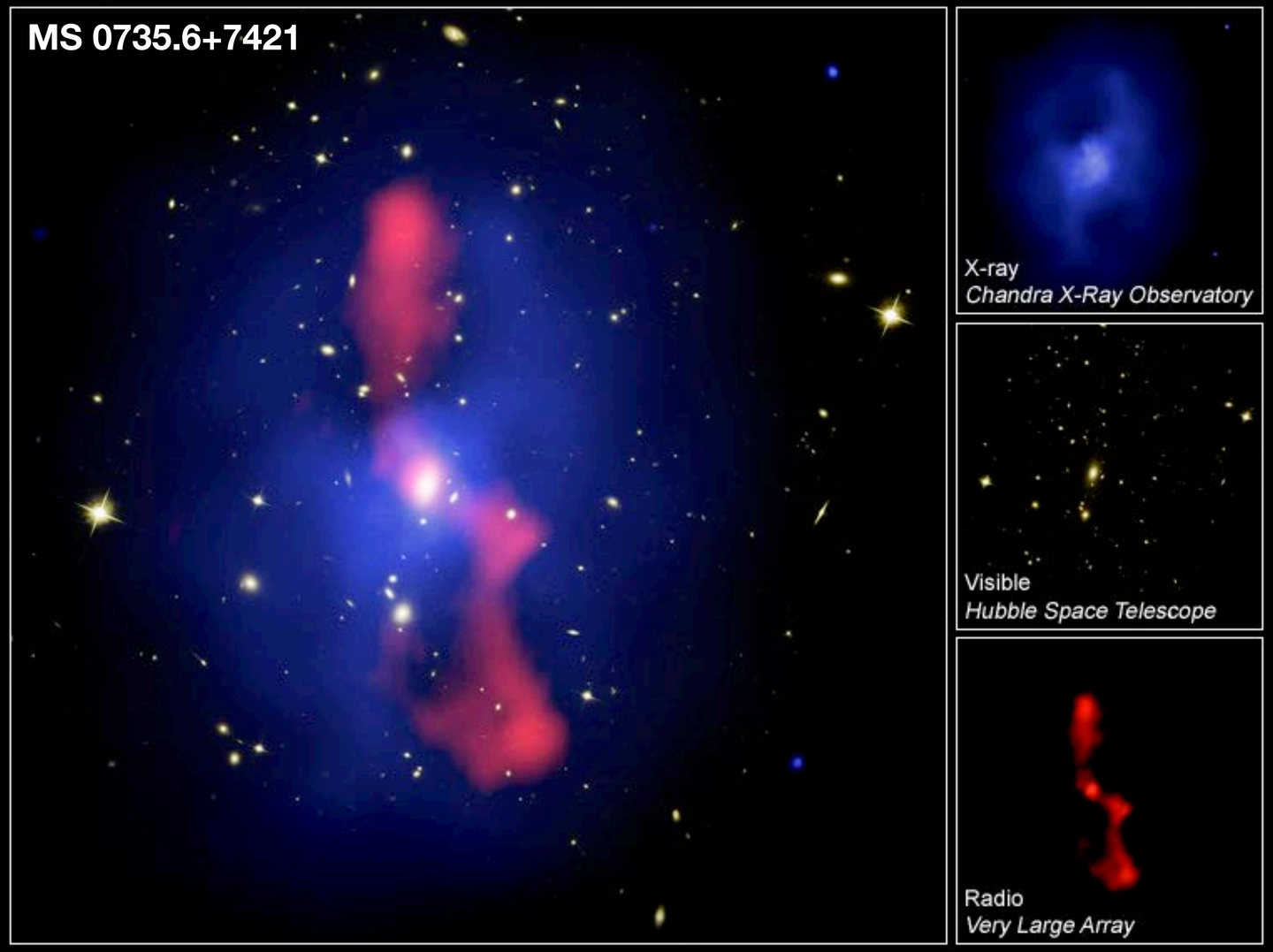
Credits Chandra X-ray Observatory

Clusters are the most massive systems of the Universe with masses of 10^{15} solar masses

Clusters contain thousands of galaxies submerged in a very hot gas known as the intracluster medium. A massive central elliptical galaxy sits at the center, which generally hosts an active black hole.

Some of these clusters are rapidly cooling as they are losing strong X-ray emissions at the center.

Black hole feedback in massive central cluster galaxies



These central active black holes often have high-speed jets of material stretching over thousands of light-years. They can exacted X-ray cavities by pushing aside the surrounding hot gas.

These X-ray cavities and bubbles may provide a direct measurement of the work done by the central active black hole on the surrounding hot gas.

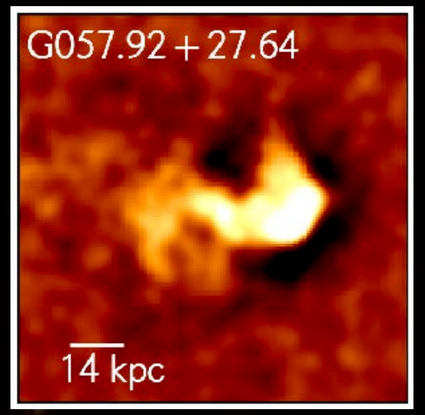
Is this black hole feedback more common in the early Universe than today?

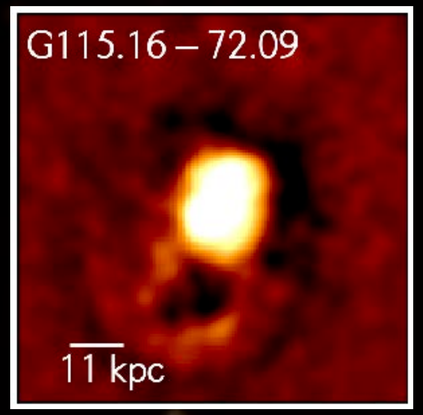
Planck sample of clusters is a nearly complete sample of nearby (z<0.35) clusters.

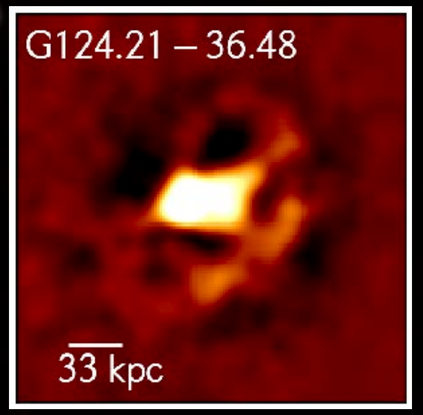
The sample contains 164 clusters.

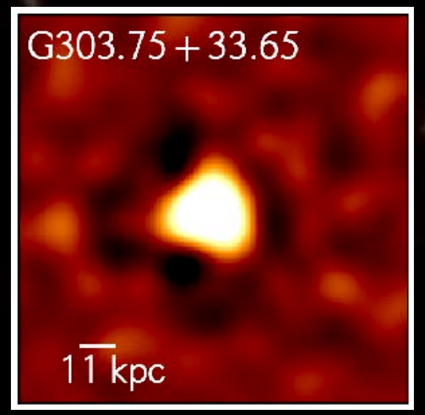
This allows us to explore the duty cycle of black hole feedback, estimated as the fraction of systems displaying cavities inflated by the central blackhole.

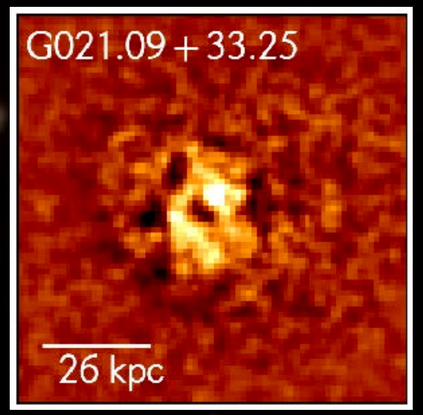
Using Chandra X-ray observations, we look for X-ray cavities in the Planck sample clusters.

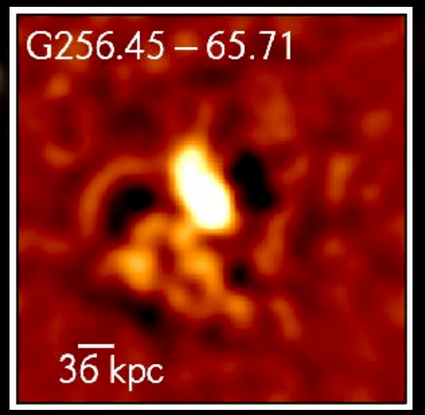


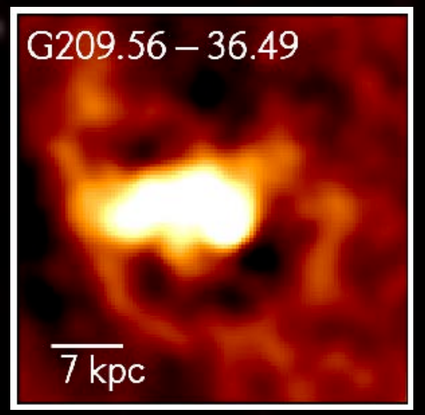


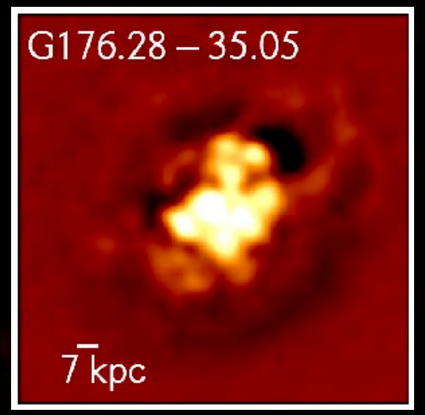








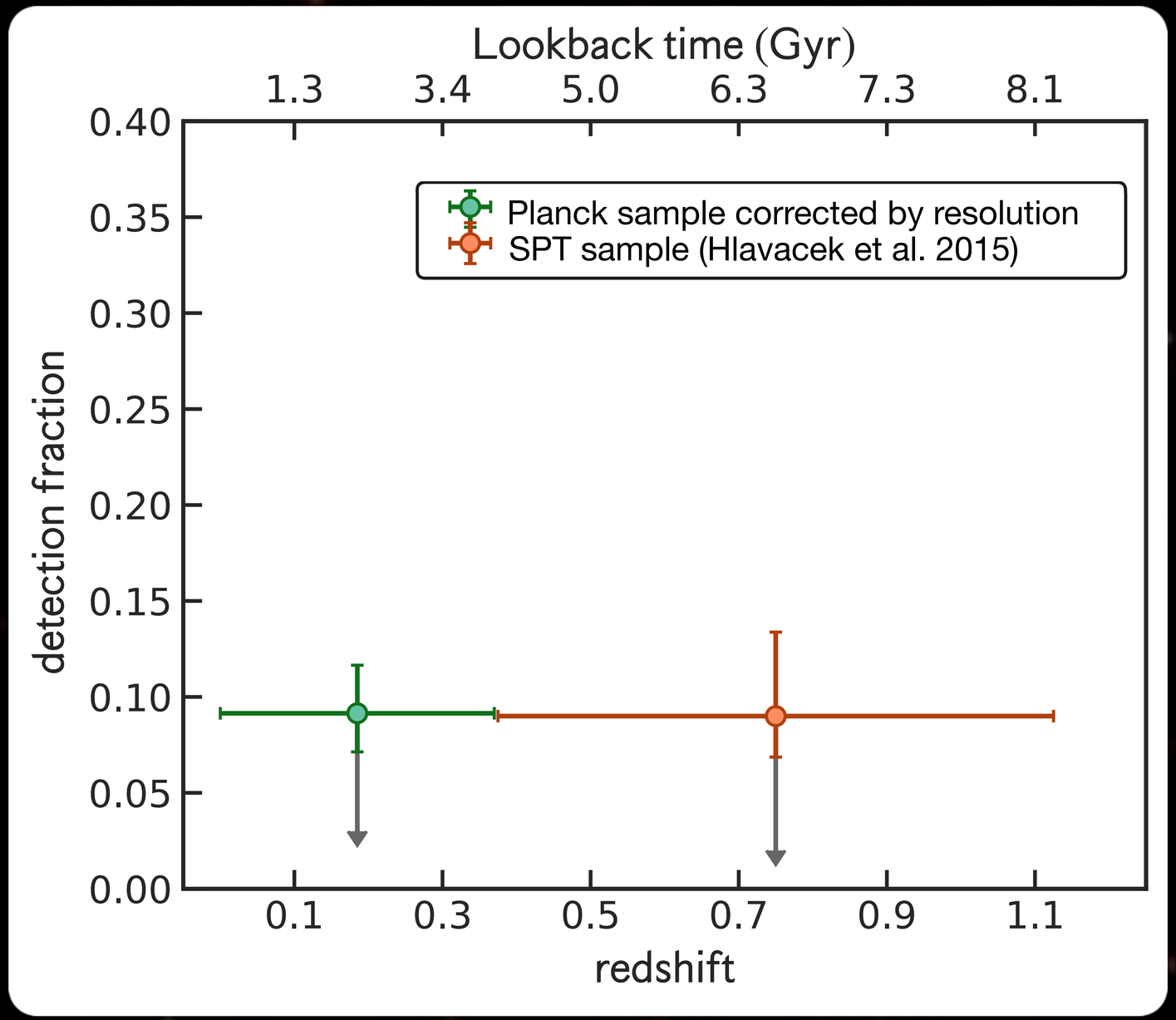




Detection of cavities is constant over 8 million years

When comparing with a sample of high redshift clusters at the same spatial resolution (10 kilo-parsecs), we find an almost constant detection fraction of 10% over 8 million years.

Hinting that the black hole feedback has not evolved in central cluster galaxies.



Implications and Take-away message

The interaction between supermassive black hole and its host galaxy in clusters has been in place since 8 billion years ago, and since then has evolved mildly.

Future high resolution X-ray observations will be needed to find more cavities in the faintest clusters and confirm our findings in high redshift clusters.