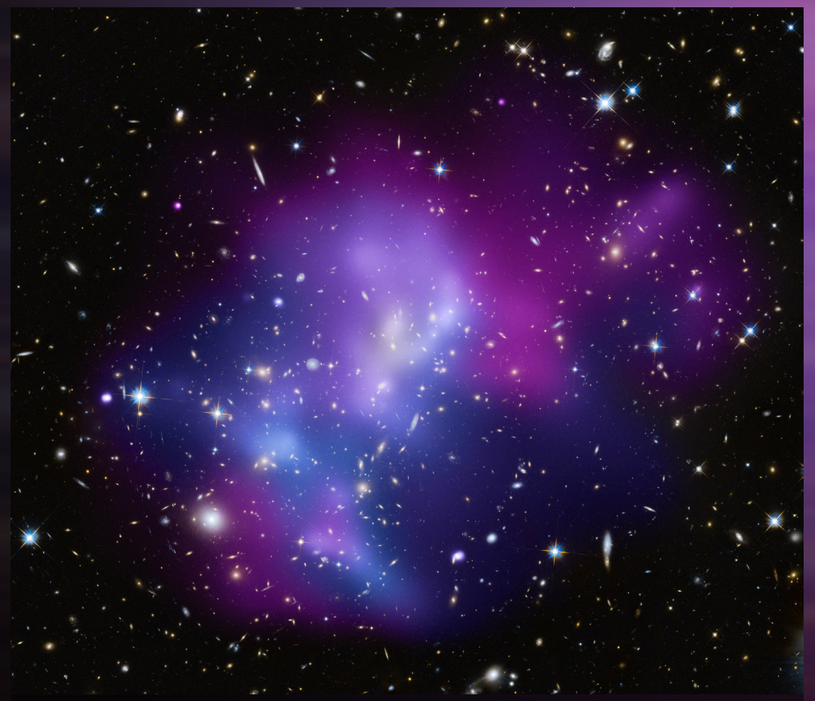
National Aeronautics and Space Administration

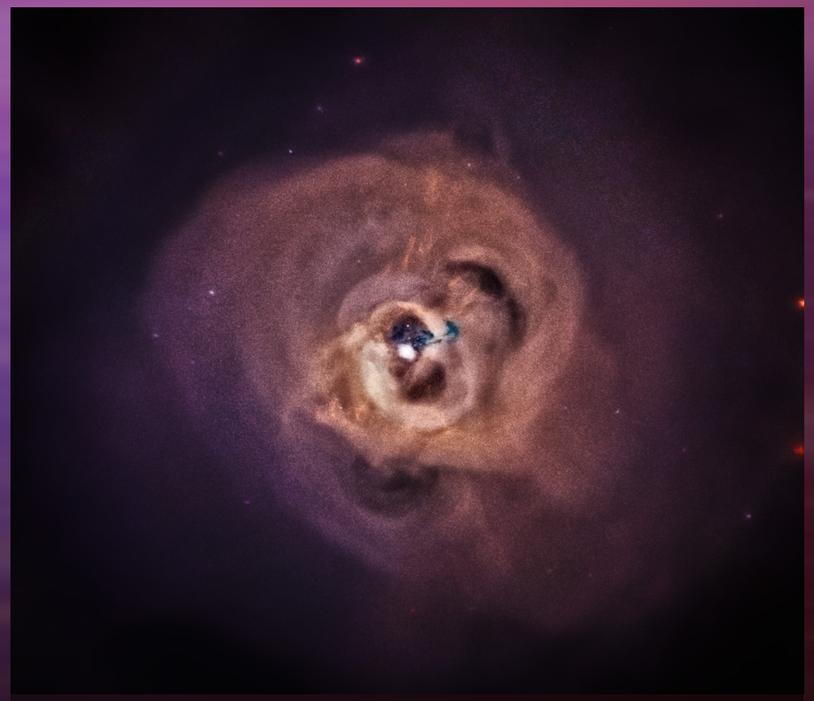
GALAXY CLUSTERS

Galaxy clusters are the largest structures in the Universe held together by gravity. These colossal structures contain three main components: hundreds or even thousands of individual galaxies, large amounts of dark matter, and enormous reservoirs of hot gas. Chandra has allowed astronomers to better understand these cosmic giants.



Chandra's X-ray images of hot gas in galaxy clusters, such as MACS J07171.5+3745, provide information on how the clusters formed, the amount of heating and cooling in the cluster, as well as the distribution of dark matter holding the cluster together.

X-ray: NASA/CXC/Ecole Polytechnique Federale de Lausanne, Switzerland/D.Harvey & NASA/CXC/Durham Univ/R.Massey; Optical & Lensing Map: NASA, ESA, D. Harvey (Ecole Polytechnique Federale de Lausanne, Switzerland) and R. Massey (Durham University, UK)



The Perseus Cluster is one of the most massive objects in the Universe, and contains thousands of galaxies immersed in an enormous cloud of superheated gas. In Chandra's X-ray image, enormous bright loops, ripples, and jet-like streaks throughout the cluster can be seen.

NASA/CXC/SAO/E.Bulbul, et al.; XMM: ESA

This system is known as the Bullet Cluster and consists of the collision of two large galaxy clusters. The energy of this impact is so extreme that dark matter and 'normal' matter have been ripped apart, providing direct evidence for the existence of dark matter.

X-ray: NASA/CXC/CfA/M.Markevitch et al.; Optical: NASA/STScI; Magellan/U.Arizona/D.Clowe et al.; Lensing Map: NASA/STScI; ESO WFI; Magellan/U.Arizona/D.Clowe et al.