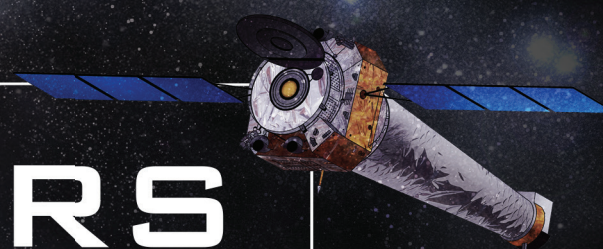
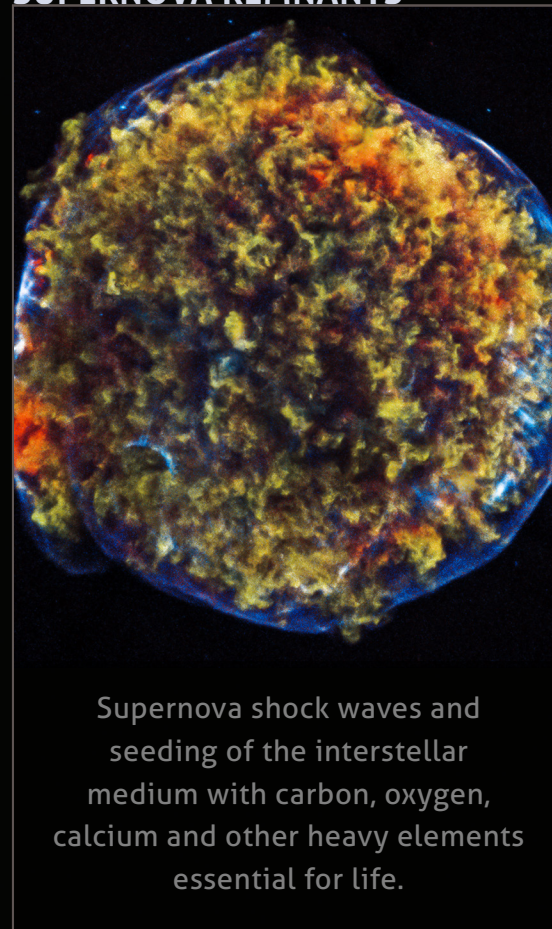


# 15 YEARS OF CHANDRA



In fifteen years of operation, NASA's Chandra X-ray Observatory has given us a revolutionary X-ray view of the Universe that is largely hidden from optical telescopes, and enabled breakthroughs in understanding.

## SUPERNOVA REMNANTS



Supernova shock waves and seeding of the interstellar medium with carbon, oxygen, calcium and other heavy elements essential for life.

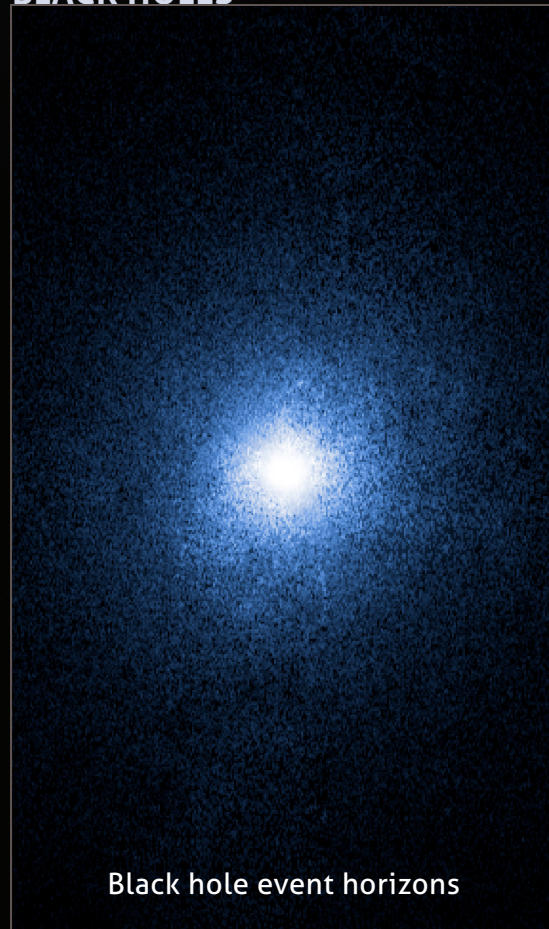
## NEUTRON STARS



Neutron star superfluids

Pulsar wind nebulas

## BLACK HOLES



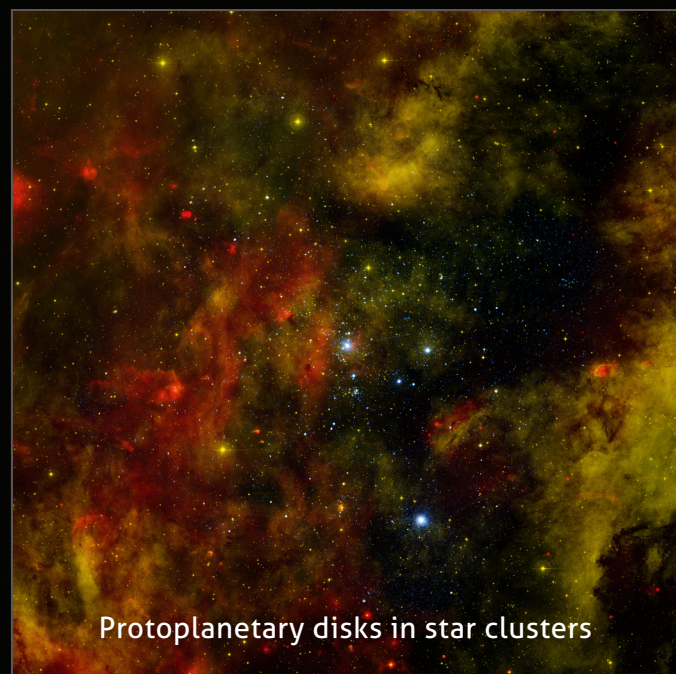
Black hole event horizons

## GALAXY CLUSTERS

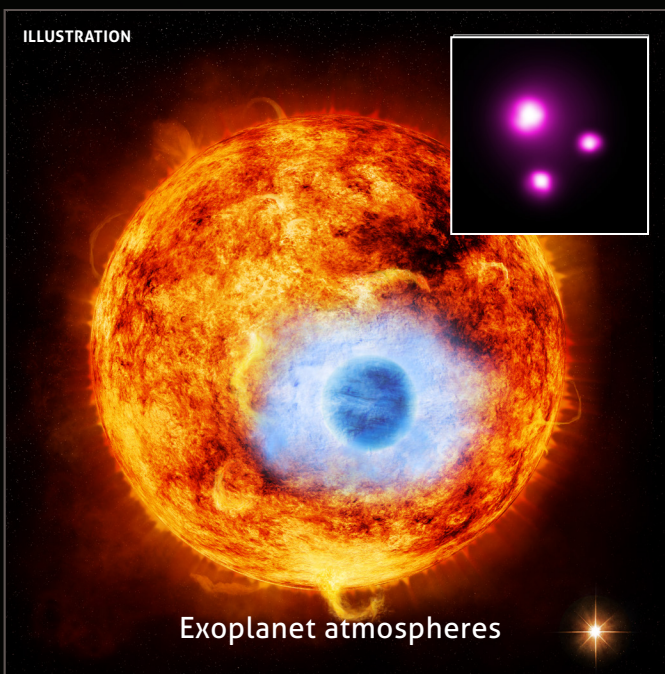


Determination of mass of clusters, and independent evidence for the existence of dark energy

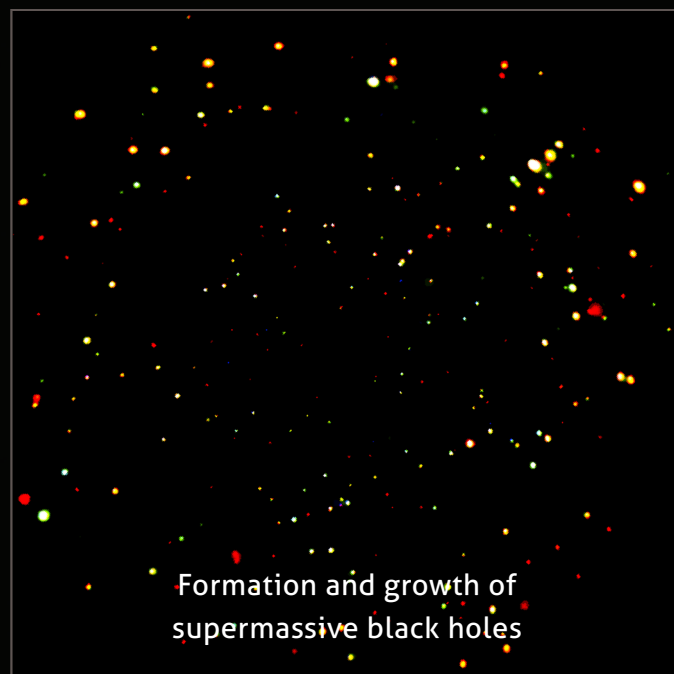
Chandra's unique X-ray mirrors give it capabilities well-matched with other major radio, infrared and optical observatories. This creates a synergy that has deepened our understanding of many phenomena:



Protoplanetary disks in star clusters



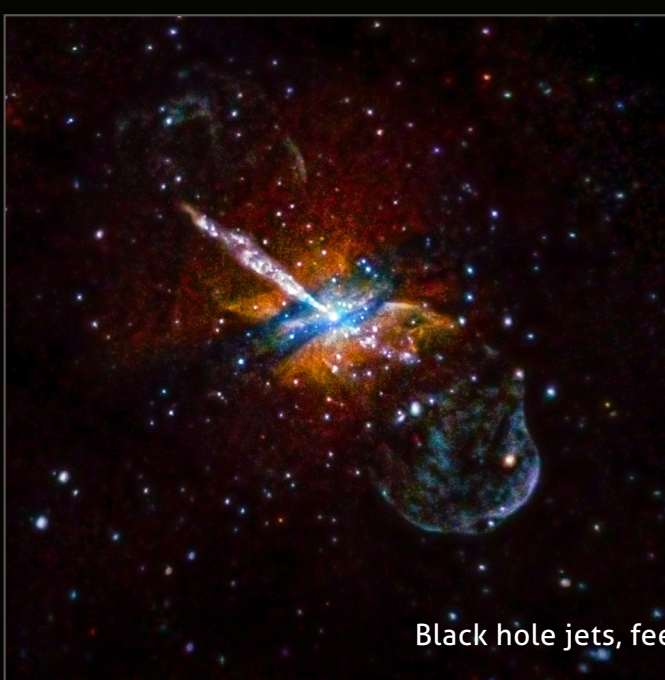
Exoplanet atmospheres



Formation and growth of supermassive black holes



Largest structures in the Universe: galaxy clusters – dark matter.



Black hole jets, feedback and galaxy growth



Chandra: Taking us on a unique voyage into the hot, high-energy Universe.

NASA's Marshall Space Flight Center in Huntsville, Alabama, manages the Chandra program for NASA's Science Mission Directorate in Washington. The Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, controls Chandra's science and flight operations.

Credits: Supernovas – Tycho's Supernova Remnant: NASA/CXC/Chinese Academy of Sciences/F. Lu et al; Neutron Stars (Top) – Cassiopeia A: X-ray: NASA/CXC/Southampton/W. Ho et al., Illustration: NASA/CXC/M.Weiss; Neutron Stars (Bottom) – Crab Nebula: NASA/CXC/SAO; Black Holes – Cygnus X-1: NASA/CXC; Galaxy Clusters – Abell 85: X-ray: NASA/CXC/SAO/A.Vikhlinin et al., Optical: SDSS; Middle Row Left – Cygnus OB2: X-ray: NASA/CXC/SAO/J.Drake et al, Optical: Univ. of Hertfordshire/INT/IPHAS, Infrared: NASA/JPL-Caltech; Middle Row Middle – HD 189733: X-ray: NASA/CXC/SAO/K.Poppenhaeger et al, Illustration: NASA/CXC/M.Weiss; Middle Row Right – Chandra Deep Field South: NASA/CXC/R.Giacconi et al. and D.M.Alexander, F.E.Bauer, W.N.Brandt et al.; Bottom Row Left – 1E 0657-56: 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.; Bottom Row Middle – Centaurus A: NASA/CXC/U.Birmingham/M.Burke et al.; Bottom Row Right – Perseus Cluster: NASA/CXC/SAO/E.Bulbul, et al.