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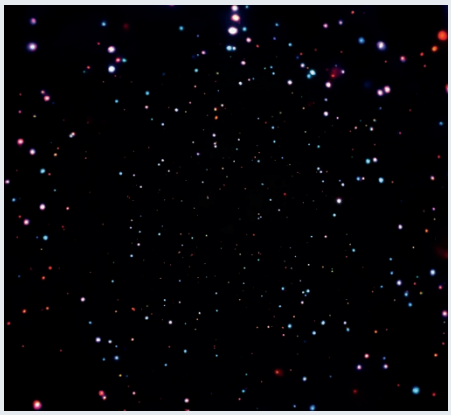
X-RAY ASTRONOMY

Black holes in the sky with Chandra

The Chandra X-ray space telescope spent a total of about 7 million seconds, the equivalent of more than 80 days, observing a small patch of the sky (about 480 square arcminutes). The result is the deepest X-ray image ever created, providing a high-sensitivity map of galaxies spanning a large part of the Universe (out to redshifts of 5) and revealing the growth of both stellar black holes and their supermassive counterparts. Being a composite of X-ray emission at different energies, the colours of the sources in this image (pictured) are indicative of their X-ray spectral properties and therefore of the emission mechanism.



NASA/CXC/PENN STATE/B.LUO ET AL.

Because of the superb ancillary data available in the same patch of the sky spanning the full electromagnetic spectrum, most of the thousand detected X-ray sources could be characterized and their distances to us measured. Roughly half of the sources were found to be powered by accreting supermassive black holes, the high luminosity of which allowed their detection as early as a billion years after the Big Bang. The other half of the sources appear to be normal galaxies, whose X-ray emission is the result of intense star formation and its end product, stellar black holes.

Pushing their data even further, Niel Brandt and his collaborators used the known positions of very high redshift galaxies to stack the otherwise individually weak X-ray emission of each one of them in an effort to tease out their average X-ray properties (F. Vito *et al.*, *Mon. Not. R. Astron. Soc.* **463,** 348–374; 2016). Amassing exposure times equivalent to a few billion seconds, first results indicate that their emission is consistent with having originated around stellar rather than supermassive black holes. This result implies that either supermassive black holes do not play a dominant role in the very young Universe or that they are embedded in thick dust that is opaque even to the very energetic X-ray emission.

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