

Abstract Submitted  
for the APR16 Meeting of  
The American Physical Society

**Probing the Hot and Energetic Universe: X-rays and Astrophysics** MARSHALL BAUTZ, MIT Kavli Institute for Astrophysics Space Research, RALPH KRAFT, Harvard-Smithsonian Center for Astrophysics — X-ray observations are a cornerstone of our understanding of the formation and evolution of structure in the Universe, from solar-system-sized supermassive black holes (SMBH) to the largest galaxy clusters. At the most basic level, a significant fraction of the energy output in the Universe is in X-rays, and much of this emission traces the response of baryonic matter to the inexorable, gravity-driven growth of cosmic structure. At present, for example, half or more of the baryons in the Universe reside in a hot ( $>1$  MK) X-ray-emitting phase. We discuss some of the remarkable progress that has been made in understanding the broad outlines of these processes with the current generation of X-ray observatories. We summarize the potential of recently launched and forthcoming X-ray observatories to track the development of large-scale cosmic structure and to understand the physics linking the growth of SMBH with that of the (many orders of magnitude larger) galaxies and clusters which host them. We briefly review nearer-term prospects for smaller, focussed missions, including one that will soon exploit pulsating X-ray emission from neutron stars to probe the equation of state of matter at nuclear densities.

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Date submitted: 07 Jan 2016

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