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Properties of X-ray Flashes Inferred from Their Afterglows and Host Galaxies

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The X-ray flashes occur at the cosmological distances of gamma-ray bursts, but possess a non-thermal spectrum that peaks in the X-ray rather than the gamma-ray band. They were identified as a distinct phenomenon by John Heise in archival data of the Beppo-SAX Wide Field Camera, and the first prompt position for any such event was provided on October 30, 2001. Since that date we have engaged in an ambitious effort to characterize the physical properties of X-ray flashes via discovery and characterization of their broad-band afterglows and host galaxies. I will present a summary of these efforts, including: Chandra X-ray, HST and ground-based optical, and VLA radio afterglow studies; HST and Keck host galaxy imaging and spectroscopy; and searches for associated supernovae. While the HETE satellite has shown that the prompt emission characteristics of X-ray flashes form a continuum with those of X-ray-rich and ordinary gamma-ray bursts, only studies of the X-ray flash afterglows and host galaxies can address the fundamental questions of their intrinsic energies, the relativistic and/or collimated nature of their explosions, and the likely nature of their progenitors.