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Observing the Earliest Galaxies: Looking for the Sources of Reionization[1]

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Systematic searches for the earliest galaxies in the reionization epoch finally became possible in 2009 when the Hubble Space Telescope was updated with a powerful new infrared camera during the final Shuttle servicing mission SM4 to Hubble. The reionization epoch represents the last major phase transition of the universe and was a major event in cosmic history. The intense ultraviolet radiation from young star-forming galaxies is increasingly considered to be the source of the photons that reionized intergalactic hydrogen in the period between the "dark ages" (the time before the first stars and galaxies at about 100-200 million years after the Big Bang) and the end of reionization around 800-900 million years. Yet finding and measuring the earliest galaxies in this era of cosmic dawn has proven to a challenging task, even with Hubble's new infrared camera. I will discuss the deep imaging undertaken by Hubble and the remarkable insights that have accrued from the imaging datasets taken over the last decade on the Hubble Ultra-Deep Field (HUDF, HUDF09/12) and other regions. The HUDF datasets are central to the story and have been assembled into the eXtreme Deep Field (XDF), the deepest image ever from Hubble data. The XDF, when combined with results from shallower wide-area imaging surveys (e.g., GOODS, CANDELS) and with detections of galaxies from the Frontier Fields, has provided significant insights into the role of galaxies in reionization. Yet many questions remain. The puzzle is far from being fully solved and, while much will done over the next few years, the solution likely awaits the launch of JWST.

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