stars. His group's analysis of abundance ratios in this sample has proven to be important for constraining the explosion physics and nucleosynthesis processes in massive stars and also for constraining the physical processes in a source of heavy elements known as the "s-process." Referee A says of this work, "In a series of papers with former graduate student Jennifer Johnson, high resolution spectra of giants ... were used to determine abundance distributions ... to assess nucleosynthesis via the rapid neutron capture (r) process, and the later slow capture (s) process. ... this work defines the state of the art." The ratios of the various elemental abundances can be traced back to the specific physical conditions and types of nuclear reactions under which they were created. The current goal for this program is to determine the nature of the first luminous objects formed in the Universe by examining the nucleosynthetic fingerprints of these objects in the atmospheres of extremely metal-deficient stars. This is currently one of the outstanding problems in astronomy and astrophysics. Very significant progress has already been made on this program, and the published papers on it have received considerable attention

A second research program of Dr. Bolte's during the review period centers on developing new observational approaches for discovering and counting (with well-quantified corrections for the many factors that govern the visibility of these objects) the lowest mass galaxy members of nearby groups and clusters. This work has an important bearing on theories of galaxy formation and was the dissertation topic of UCSC graduate Kathleen Flint. She went on to a prestigious Carnegie Postdoctoral Fellowship in large part because of the success of this program.

Dr. Bolte's third major research area has been identifying complete samples of white dwarf in star clusters. White dwarfs are the final end-states of most stars, but it is uncertain what is upper mass for a star that ultimately becomes a white dwarf. Stars are born with different amounts of mass ranging from around 100 to 1/100th the mass of the Sun. There is a critical mass—thought on theoretical grounds to be roughly eight solar masses—above which stars undergo an instability in their core which leads to a catastrophic explosion called a supernova type II. Stars with initial mass below this critical mass end their lives quietly as white dwarf remnants. Bolte's program is using the white dwarf populations he has identified in star clusters of various ages in the Galaxy to make the first rigorous observational determination of value of the critical mass. The rate that stars age depends sensitively on their mass, with the massive stars aging much more rapidly than low-mass stars. The age of a cluster is measured by determining the mass for stars in it that separates those that have evolved to their end state from those that are still normal, mature stars burning hydrogen. He is determining that cluster age which separates clusters which have white dwarfs from those that do not. This work has many ramifications, as the value for the critical mass determines the number of exploding stars in a given stellar population and governs the chemical enrichment and kinetic energy input by supernovae. The program is also yielding new insights into white dwarf cooling evolution. Part of this program was the basis for former UCSC graduate student Kurtis Williams' dissertation. Though this research represents a relatively new area of investigation for Dr. Bolte, Referee A writes, "With former graduate student Kurtis Williams, Mike has been the leader in studying white dwarfs in Galactic disk clusters, as well as in globular clusters."