Boulder's NIST helps astronomers view invisible space dust

New sensors can measure submillimeter radiation
By Laura Snider, Camera Staff Writer

Technology developed by the National Institute of Standards and Technology in Boulder is now helping astronomers get a better look at the cold cosmic dust clouds that coalesce in the universe to form new stars and planets.

Those clouds of dust absorb visible light, making them difficult to detect with traditional optical telescopes. But they do emit some light waves that signal their presence -- it just happens to be light that isn't visible to the human eye, known as submillimeter radiation.

Submillimeter radiation has shorter wavelengths than radio waves and longer wavelengths than visible light, and scientists have found that the instruments they traditionally have used to "see" radio waves and visible light are not able to effectively detect the submillimeter signals emitted from space.

"It's a really interesting part of the spectrum because of how hard it has been to develop technology there," said NIST physicist Kent Irwin. "It's been very, very slow for technology to work in the submillimeter region.

Irwin and his colleagues, including NIST physicist Gene Hilton, now have developed superconducting detectors that can measure submillimeter radiation from space. A new submillimeter camera that contains 10,000 these NIST-built sensors is now mounted on the James Clerk Maxwell Telescope on Mauna Kea in Hawaii.

The camera, known as SCUBA-2, replaces the original SCUBA, or Submillimeter Common-Use Bolometer Array, which was retired in 2005. SCUBA-2 will be able to map the sky -- especially the cold dust and gases that release submillimeter radiation -- 1,000 times faster than its predecessor.

"Essentially, SCUBA-2 will be able to take the same measurements in a few hours that once took a week," Hilton said.

NIST's sensors measure submillimeter radiation using the superconducting metal molybdenum-copper. When the metal is cooled to the point where it loses its electrical resistance, it becomes extremely sensitive to submillimeter radiation, which adds heat to the superconductor. A thermometer in the sensor then measures the heat added by the submillimeter radiation.

The SCUBA-2 camera is now up and running, scanning the universe, while Irwin and Hilton already are thinking about how to pack even more of their superconducting sensors into future cameras.

"The goal is to keep moving up to larger and larger arrays," Irwin said. "This is 10,000 (sensors). We'd like to make something that's 100,000."