# Astronomical Imaging

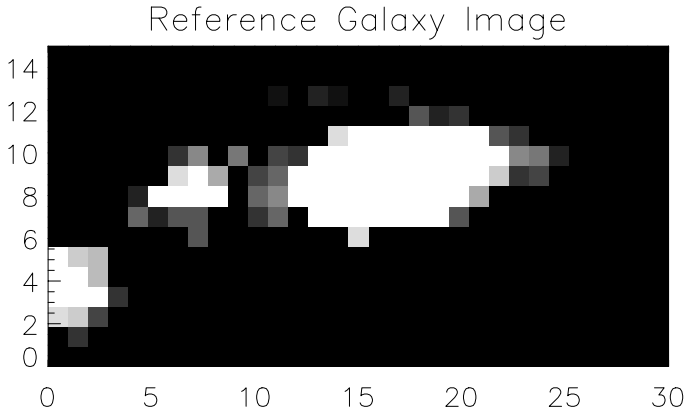
*(thanks to Steve Holland, Engineering Div. LBNL)*

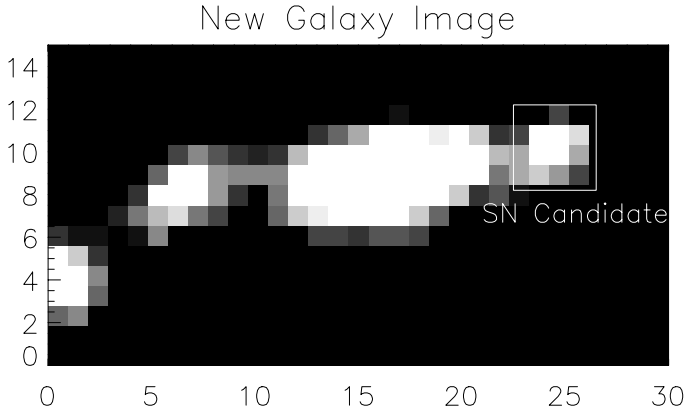
Practically all faint light imaging in astronomy relies on electronic sensors

- visible light
- IR
- UV
- x-rays

# Example: Supernova Search

*(S. Perlmutter et al., see www-physics.lbl.gov)*



# Image sensors are arrays of pixelated semiconductor detectors, called CCDs (charge coupled devices)

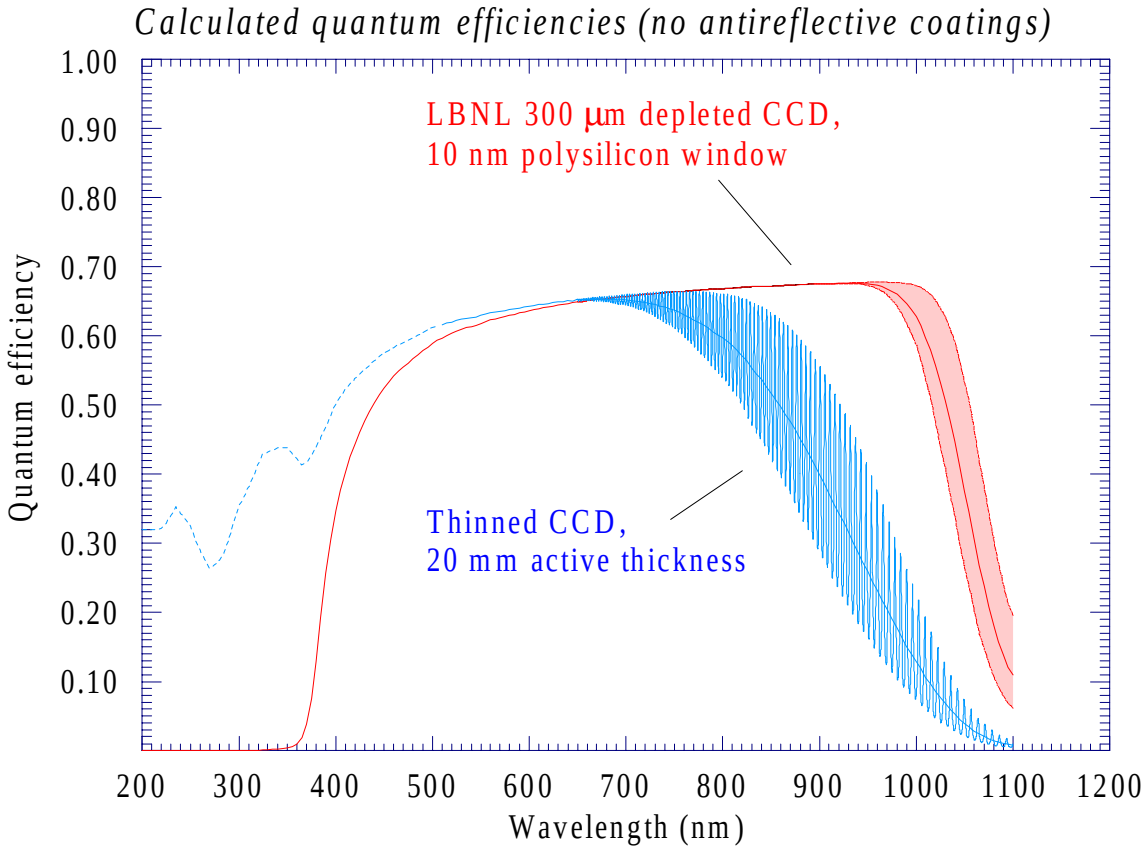
## Planetary Nebula NGC7662 (CCD at -120°C)

Photon flux in outer halo is $\approx$ 35 photons/pixel/sec, image generated from 100 sec exposures at different $\lambda$, Lick 1-m

Similar CCDs are widely used in camcorders, but astronomical imaging requires much greater sensitivity and the ability to record *very* small signals (order 1 electron).

At LBNL a novel CCD has been developed in conjunction with the supernova group.

Quantum Efficiency of Fully Depleted LBNL CCD
vs. Conventional Thinned CCD



Comparison between thinned CCD (bottom/left) and deep depletion device. Interstellar dust tend to absorb in the blue, so extended red response of LBNL CCD shows features obscured in thinned CCDs.