



Photometry with CCD Camera

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An Outline

- * What are CCDs ?
- * CCD-Vs-Photographic Material
- * CCD Photometry
- * Preparation



What are CCDs ?

- * Brief History
- * Charge-Coupled-Devices
- * Size & Price



Brief History

- * Memory Chips

- * JPL 1973

Charge-Coupled-Devices

A decorative vertical graphic on the left side of the slide, consisting of a dark blue vertical line with a series of light blue and cyan ribbons spiraling around it. A small white sphere is positioned on the dark blue line, just below the title.



Size & Price

- * 8192 x 8192 pixels

- * 7 micron - 30 micron pixel

- * 2048 x 2048 pixels

- US \$ 110,000

CCD-Vs-Photographic Material

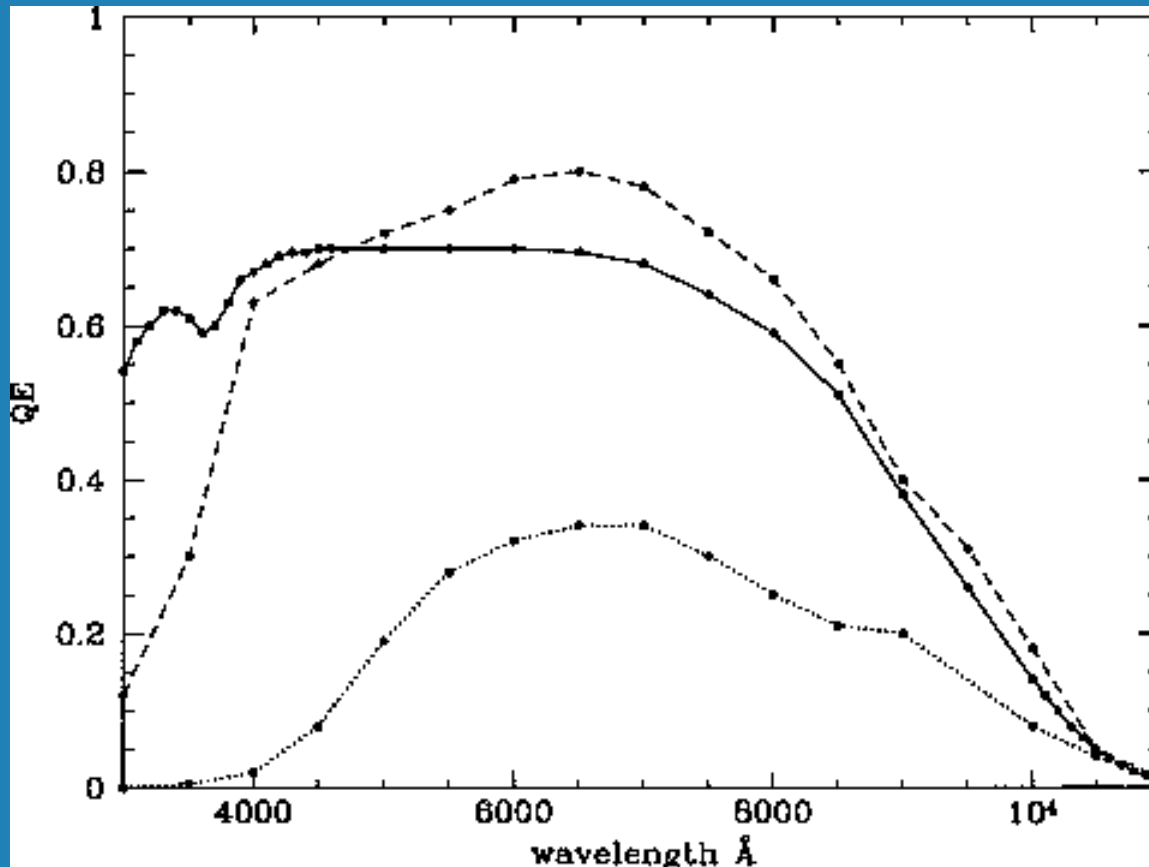
* CCD Camera

- high QE (80%)
- linear respond
- digital format
- easy to process
- 'real-time'
- size limitation
- 'low' resolution
- expensive

* Photographic Material

- low QE (< 2%)
- non-linear respond
- A/D Conversion
- dark room skills
- not 'real-time'
- no size limitation
- 'high' resolution
- inexpensive

Respond Curves





CCD Photometry

- * Standard Stars
 - primary standards
 - secondary standards
- * Photometric System
 - standard filters
 - SDSS photometric system
- * Signal-to-Noise Ratio



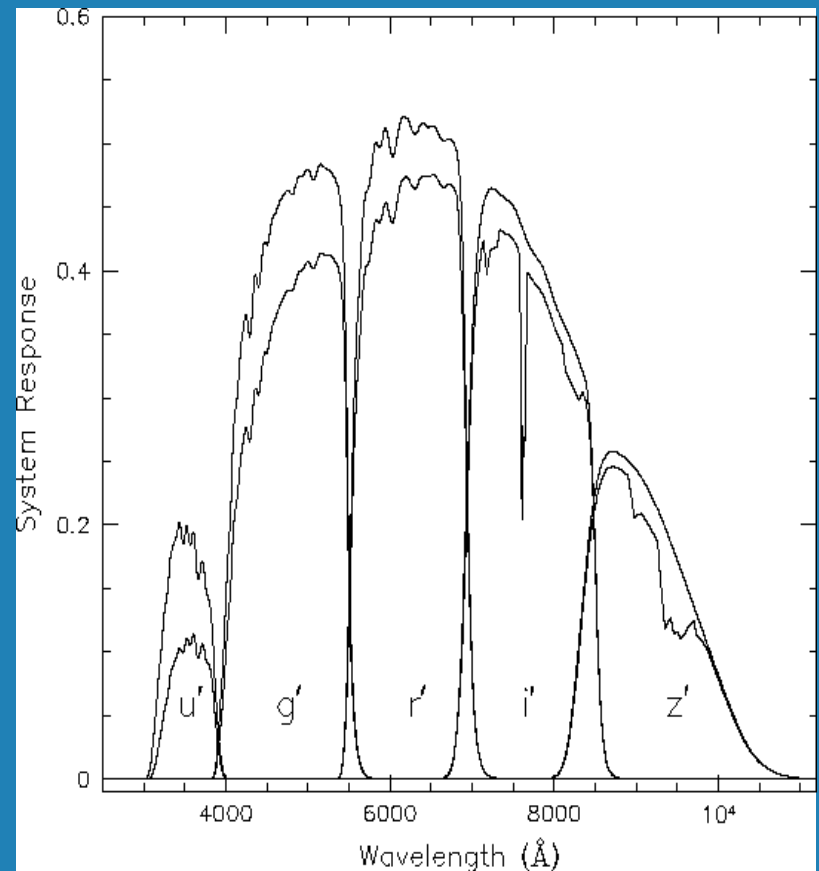
Standard Stars

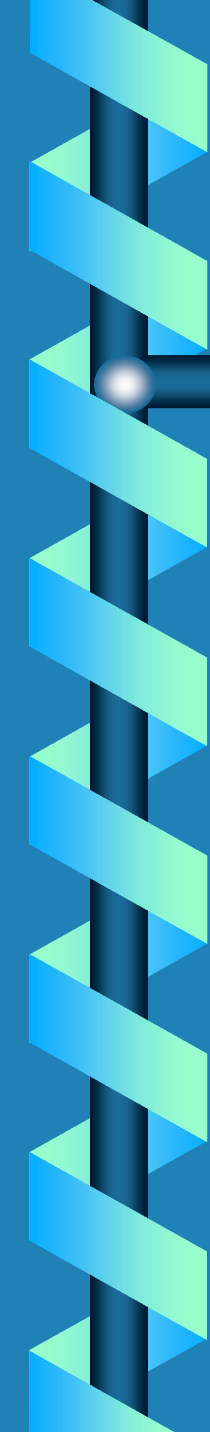
* Primary Standards

* Secondary Standards

Photometric System

- ✧ Standard Filters
- ✧ SDSS Photometric System





Signal-to-Noise Ratio

* Signal

- photons from object

* Noise

- dark current
- read noise
- bias-level & gain
- photons from sky & object



Preparation

- * Telescope
- * CCD Camera
- * Object List
- * Finding Charts
- * Photometric System (Standard Filters)
- * Standard Stars List