Problem Set 2

Prof. Beck–Observational Techniques

Due April 13 (last day before Pesach Vacation)

1 Problem 1

What element (or combination of elements) could make a detector for observing the following astronomical objects: **a)** A proto-stellar disk of temperature 250 K.

b) A Class T methane dwarf of temperature 1000 K

c) The coldest known brown dwarf at 550 K.

d) A normal A star.

e A normal G star.

2 Problem 2

An CCD system for amateur work might have a 16-bit A/D converter, read-out noise of $5e^-/pixel$, and "full well" of 5×10^5 $e^-/pixel$. What is the dynamic range? What is the dynamic range in terms of magnitudes? How many electrons/data number should you use to get full advantage of the dynamic range?

3 Problem 3

Imagine a uniformly illuminated CCD–a perfect flat field. It has m pixels. After n transfers the output signal will not be uniform because the charge transfer efficiency (CTE) is not perfect. If the m^{th} pixel has charge V_m, and the first pixel has a charge deficit of V_d, show that the CTE is approximately $(1 - V_d/V_m)^{1/n}$.