Name: _____

Homework 2 – Ast 399 – Spring 2003
Due Fri February 21, 2003

1. On the attached sheet of paper is information about an occultation of an 6.6 mag star by the asteroid Interamnia, which will occur on UT March 23, 2003, at 09:43:00 UT. An occultation is like an eclipse, it is when the asteroid will pass directly over the star, effectively casting a shadow on earth. The shadow path is typically very narrow. The occultation path will pass directly over Hawaii for this event. Because we know the occultation velocity in the sky plane, by timing the duration of the event, we will trace a chord across the asteroid. If many observatories do this, we will get a full 2-D map of the shape of the object. See the attached page for some examples of occutations (345 Tercidina, 9/17/02, and 423 Diotima, 3/15/01).

   (a) What Local time (HST) will the occultation occur? If we were to set up for this event on what date and time do you think you would show up to get set up? [5]

   (b) The coordinates of the target star are α (2000) = $07^h27^m9.11^s$ δ (2000) = $+11^\circ57'17.9''$. What HA, and airmass (χ) will this object have at the time of the occultation? [5]

   (c) Use the SIMBAD data system on the web (see the link on the class website) to find the HD catalog number and the SAO catalog number for the star being occulted, HIP 036189. [3]

   (d) Make a finder chart of this field suitable for naked eye observing. [10]

   (e) For this class, we have access to an 10-inch Cassegrain focus telescope, and an SBIG 237 CCD camera. Using the SBIG website (see class web resources page), under Products, look up the Quantum Efficiency curve of the ST-237. What wavelength does it peak? The spectral type of the star to be occulted is K0. Use the table below to determine what the λ_{max} is for a star of this temperature. What broadband Kron-Cousins filter do you estimate you will get the most signal through for this event and why? [12]

Class	Temp [K]	B-V
O	$>$ 25,000	-0.45
B	25,000-11,000	-0.20
A	11,000-7,500	0.00
F	7,500-6,000	+0.40
G	6,000-5,000	+0.60
K	5,000-3,500	+1.00
M	$<$3,500	+1.50

(f) According to the fact sheet for the event, the duration is 62.9 sec. The SBIG ST 237 CCD takes about 7 sec to read out. A 6.5 mag star on a 10-inch telescope will take only a few seconds to get a good image. However a star near V=12 mag may take 2-3 10-sec images stacked for detection. How practical will it be to try to observe this event with our 10-inch telescope? [10]

(g) Is a CCD the best type of instrument for this observation? If not, what else might be better and why? [5]

2. Below is a table of MKO telescope mirror diameters, and focal lengths. Use this to answer the following questions.

Telescope	Mirror Diam [m]	Focus	f/#
UH 2.2m	2.2	Cassegrain	f/10
UH 2.2m	2.2	Coude	f/33.8
CFHT	3.6	Prime	f/3.77
UKIRT	3.8	Cassegrain	f/36.4

(a) Which telescope has the greatest light gathering power? [3]

(b) The UH2.2m and CFHT are primarily telescopes that operate in the visible wavelengths (0.3-0.8 μm) and UKIRT is an infrared telescope. Calculate the best resolution for the UH2.2m at V band, and for UKIRT at K-band (2.2 μm). At which telescope will we get the best resoltuion? [5]

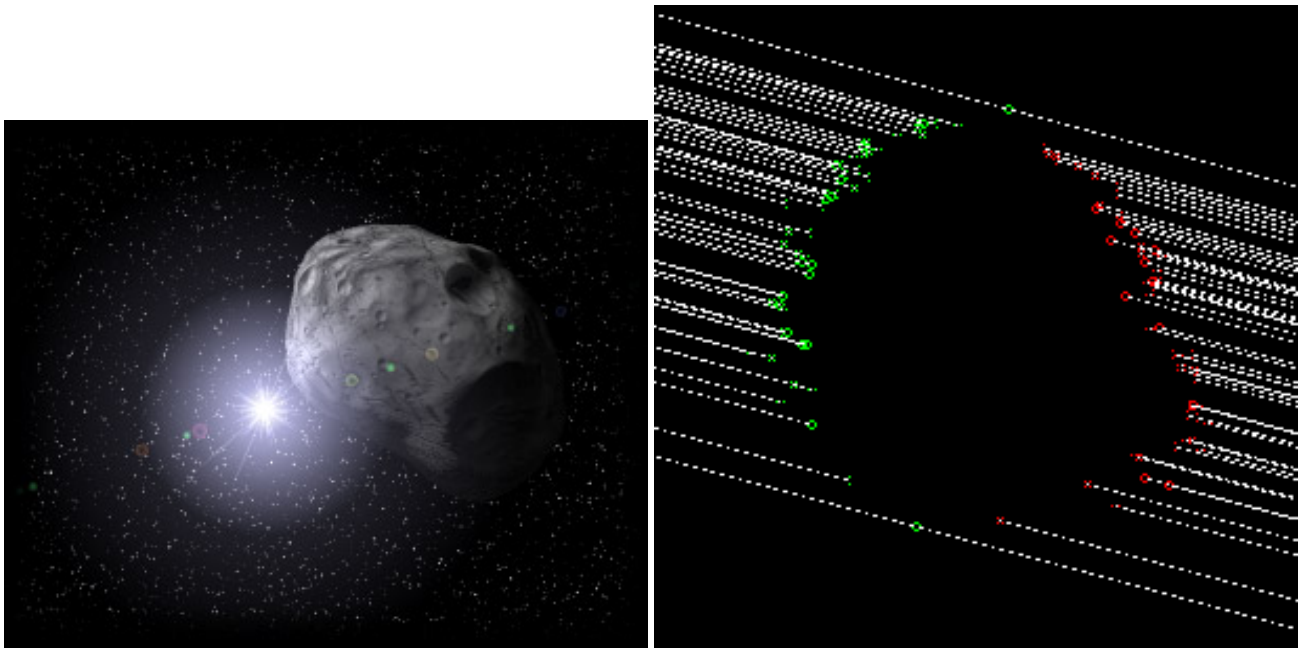

Figure 1: View from space of what an occultation must look like; Map of Asteroid Tercidina from 75 occultation chords

Figure 2: Sequences of images during an occutation showing the dimming as the asteroid passes in front of a star

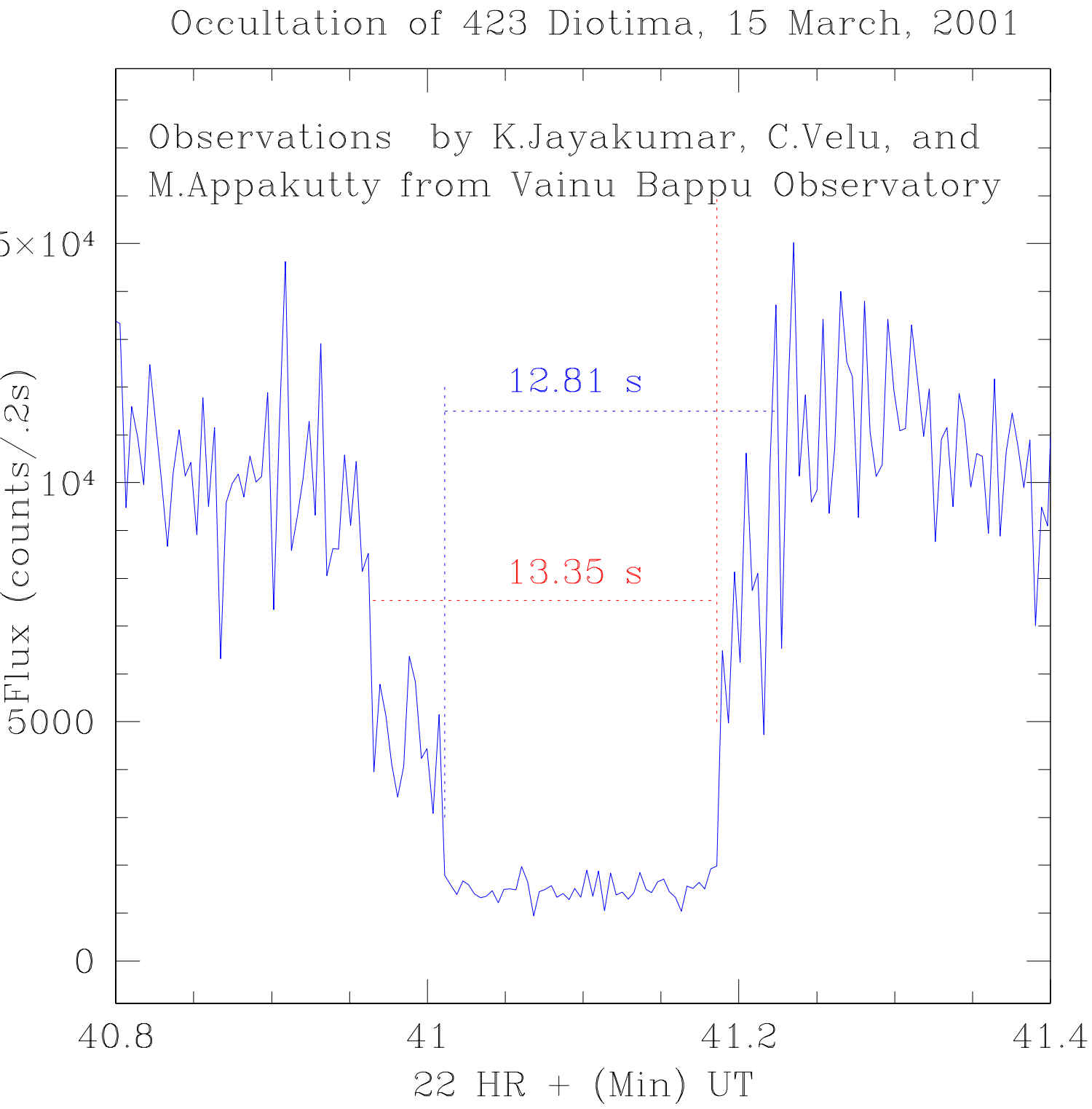

Figure 3: Occultation light curve of Asteroid 423 Diotima