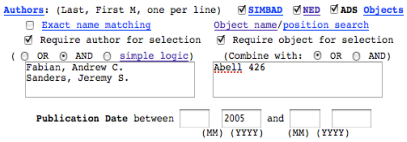
Homework Assignment
Science Communication and Literature Searches
Due: 3:30 PM, Wednesday, October 27

For any of the questions involving calculations, you should show the details of these calculations. You will be graded not only on the answers that you provide, but on demonstration of the steps and reasoning involved in deriving those answers.

1. This problem involves practice conducting literature searches using *ADS*. Open a web browser and navigate to the *ADS* Astronomy Query Form webpage by going directly to **http://adsabs.harvard.edu/abstract_service.html** (or via **http://www.adsabs.harvard.edu/**). In each case, explain what kind of query you did (what was queried on, and how these were combined).

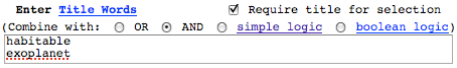
a) How many references since 2005 about the Abell 426 cluster (the Perseus Cluster) include Andrew C. Fabian and Jeremy S. Sanders as co-authors?

The answer here is *25* from the following search:



b) How many references with the words "habitable" *and* "exoplanet" in the title are there since 2008? Before 2008?

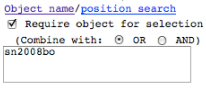
The answers are 28 and 20, respectively, from the following search:



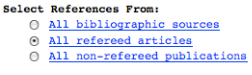
This finds all 48 references, and one may simply count the ones before and after 2008.

c) Do an object search on the subject of this week's lab, SN2008bo. How many references are there? How many refereed articles?

There are nine total, and two refereed articles:



where for the second part, one must use the filter



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2. Using the reference list from 1c) above, find the distance to SN2008bo.

In the abstract to reference 7, a distance of *21 Mpc* is quoted.

a) Use this to derive a conversion factor from X-ray flux in erg/cm^2/sec to X-ray luminosity in units of 10^{40} erg/sec.

$4\pi d^2/(10^{40}$erg/sec) = $4\pi \times$ (21 Mpc $\times 10^6$ pc/Mpc $\times$ 3.0856 10^{18} cm/pc)$^2/(10^{40}$erg/sec)

= 5.28 $\times 10^{12}$ [erg/cm^2/sec]$^{-1}$

b) Copy the **IDL** procedure you revised in the lab, lcurve.pro, to lcurve_old.pro. Edit lcurve.pro and change the conversion factor from 1.0 to the number you calculated in part (a) of this question. Introduce a new luminosity variable at that point in the program, and plot the X-ray luminosity versus time light curve. Also, make the appropriate changes to your plot labels.

c) Start up **IDL.** Compile and run the new version. Save the postscript plot for inclusion in you paper.

Please attach hardcopies of your final version of lcurve.pro, and the postscript file that it produces, to your assignment.

Your program, to be compiled and run in IDL using *.run lcurve* and *lcurve, 'lcurve.dat'* , might look something like the following:

pro lcurve, datafile

```
; plots lightcurve (luminosty in units of 10e40 erg/sec vs.time) with
; errors in the postscript file lcurve.ps

array = FLTARR(3,13)       ;create a 3 (cols) X 13 (rows) floating point array
OPENR, unit, datafile, /GET_LUN ;open file for reading, allocating a free unit
READF, unit, array ;read the contents of the file into the array
;HELP, ARRAY
tday = REFORM(array[0,*]) ;create a vector consisting of the 1st column of array
flux = REFORM(array[1,*]) ;create a vector consisting of the 2nd column of array
flux_err = REFORM(array[2,*]) ;create a vector consisting of the 3rd column of array
;HELP, tday, flux, flux_err

;PRINT, tday, flux

ysize=N_ELEMENTS(flux); number of points
;npoints=FINDGEN(ysize)
;PRINT, npoints, flux
;PLOT, npoints+1, flux, XRANGE=[0,ysize+1], PSYM=1

con = 5.276e12 ;conversion factor <<NOT 5.276*(10^12)>>
xlum = con * flux
xlum_err = con * flux_err

; set up vectors for plotting errorbars
xlumup = xlum - xlum_err
xlumdown = xlum + xlum_err

; plot data on the screen
xaxis_fac=1.1 ;to set up the maximum x-value in the plot
xmax=xaxis_fac*MAX(tday)
yaxis_fac=1.2 ;to set up the maximum y-value in the plot
ymax=yaxis_fac*MAX(xlum)
PLOT, tday, xlum, XRANGE=[0,xmax], YRANGE=[0,ymax], PSYM=7, $
        XTITLE='time in days', YTITLE='X-ray luminosity'

; overplot errors

        for i = 0,ysize-1 do begin

                ex = [tday(i),tday(i)]
                ey = [xlumdown(i), xlumup(i)]

                OPLOT, ex, ey

        endfor

; set up for postscript file output
SET_PLOT, 'ps'
DEVICE, filename='lcurve.ps'
; plot data in the postscript file lcurve.ps

PLOT, tday, xlum, XRANGE=[0,xmax], YRANGE=[0,ymax], PSYM=7, $
        XTITLE='time in days', YTITLE='X-ray luminosity', CHARSIZE=1.5
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```
; overplot errors

        for i = 0,ysize-1 do begin

                ex = [tday(i),tday(i)]
                ey = [xlumdown(i), xlumup(i)]

                OPLOT, ex, ey

        endfor

DEVICE, /close
SET_PLOT, 'x'
FREE_LUN, unit

end
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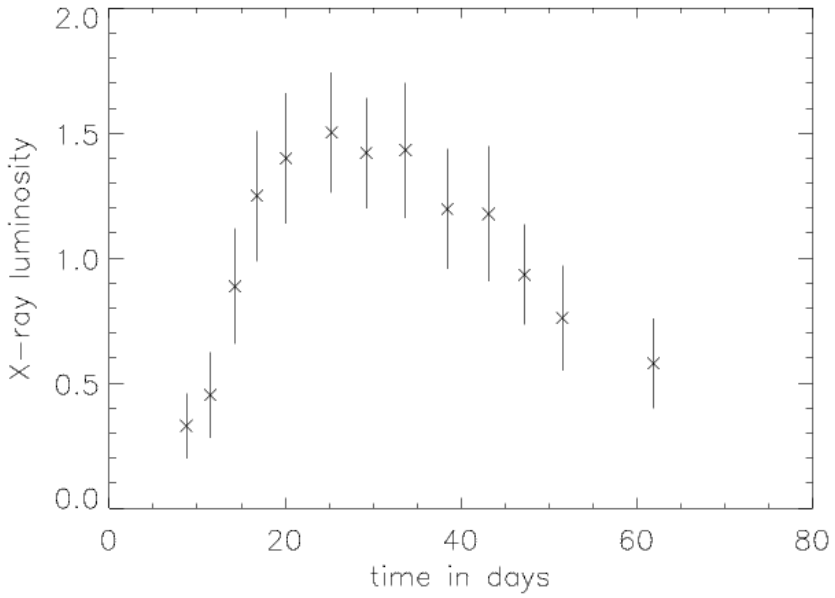

3. Write a very short "paper" using the lcurve.tex template file that you downloaded. The other relevant files are the AAS class file aastex.cls and the postscript file generic.ps that you will replace with the luminosity light curve figure that you created in question 2 above. This document will begin with a title, author's (i.e., your) name, affiliation , and e-mail address. This is to be followed by an abstract, an introduction section, a section on the SN2008bo lightcurve with analysis and results subsections, and a bibliography. A few sentences (at most) per section should suffice – this is more of an exercise in style than in substance. Remember to embed your luminosity lightcurve postscript file in the text.

Create the **LaTeX** file by editing lcurve.tex. Detailed instructions, along with some general tips and information, are included in the file and can be read by creating and opening lcurve.ps or lcurve.pdf:

```
> latex lcurve.tex
> latex lcurve.tex
> dvips -o lcurve.ps lcurve.dvi
```

> ps2pdf lcurve.ps lcurve.pdf

Please attach hardcopies of your LaTeX source file, and the .ps or .pdf file of your paper to your assignment.