Setting up a Mac for Astronomy

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Abstract

This document is the result of my frustrations at setting up multiple macs for astronomy use. It is a list of all the software I find handy for everyday astronomy use, along with the links to download and notes on any installation eccentricities I've come across. This list is by no means exhaustive, merely a list of the software I use most commonly in my PhD, written for someone starting out in astronomy. Instructions are complete and tested for OS X 10.9.x Mavericks on both a Macbook Pro and an iMac. The following is split into sections based of software type, but you should install these sequentially as some of the earlier installs are required for later software. The first thing you'll need to do before you attempt any installation of software is to check you have admin privileges on your user account. If not, make sure this is changed before you try anything else!

Contents

1 Basics - to do first!

The following are basic programs required for modern astronomy.

1.1 X-Quartz

X-Quartz is a component of the X window system, which is a standard framework for creating applications with a GUI on Unix-like operating systems. It is used to run a lot of scientific software that is not specifically designed for OS X, for example, IRAF, GAIA and DS9. It is essential to run many astronomy programs.

Installation

Double-click the dmg file downloaded at `http://xquartz.macosforge.org/landing/`.

1.2 Xcode & Command Line Tools

Xcode is Apple's set of software development tools (along with a nice text editor). The command line tools must be installed separately but contain a C compiler needed for other software.

Installation

Xcode: From the App store.
Command Line Tools: In the terminal, type `$ xcode -select --install`, or follow the instructions at `http://railsapps.github.io/xcode-command-line-tools.html`

1.3 gfortran compiler

Needed to compile Fortran code, which can pop up when you're trying to install other things, such as GAIA.

Installation

The dmg file can be found at `https://gcc.gnu.org/wiki/GFortranBinariesMacOS`.

1.4 wget

WGET is a software package for retrieving files from HTTP, HTTPS and FTP. Many data sets are only available this way, and collaborators may like to send you data in this manner also.

Installation

This is covered well by `http://coolestguidesontheplanet.com/install-and-configure-wget-c`
I have only tried Option 2 - compile from source, but Option 1 should be easier.

1.5 An Astronomy Software Package Bundle - SciSoft or Ureka

Update 07/07/16 - I've installed IRAF and ds9 on my iMac running El Capitan. The following instructions detail how to do it without getting bogged down with the larger packages of SciSoft and Ureka. Once you have wget (which you can get from brew/homebrew), follow the instructions on the sites `spacepioneers.in/?p=489`, OR `www.ac.es/sieinvens/siepedia/pmwiki.php?n=HOWTOs.IrafMacOSX`. **Make a note of the Note for El Capitan users.** Follow the instructions on these webpages to the tee, then, when you get down to 'Set up Iraf' section, make the directory, THEN, start XQuartz up, open an Xterm, type xgterm &, then do the remainder (including the mkiraf) from there. In the xgterm, do the fix that includes the environmental variables before you call iraf:
- export iraf=/iraf/iraf/ #(trailing slashes important, so too are no spaces between =)
-export tmp=/tmp/
-export host=/iraf/iraf/unix/
-export IRAFARCH=macintel
-source $iraf/unix/hlib/irafuser.sh

The above commands can be placed in your ∼ /.bashrc file. Once you source ∼ /.bashrc, everything should work.
To run IRAF: cd ∼/iraf/ then ecl

Both of these packages are large, unwieldy and SciSoft can be difficult to install, but contain many of the programs used in everyday astronomy, for example the image

viewer DS9, or IRAF. You should chose one. SciSoft is the traditionally used but less often updated package, including (but not limited to) GNUPLOT, IRAF, SEXTRACTOR, and a python distribution. Ureka is more recent, containing IRAF and python, along with visualisation tools DS9, ipython, pyraf and xgterm. Check Appendix A for Scisoft installation instructions.
Update 02/02/15 - Use Ureka!! I have downloaded and tested it, it works much better than SciSoft!!

2 TEX distribution

LATEX(pronounced 'Lay-tech') is a scientific document preparation system. Absolutely everyone uses it in astronomy to write scientific articles, books, your thesis etc. It is particularly useful for writing reports as it automatically formats your work to look pretty. All you need to do is insert the words and figures/ tables etc. You will need to download a TEX distribution and a front end to edit and view your work such as TEXSHOP, TEXWORKS, or LYX. I use MACTEX and TEXSHOP.
JABREF is an excellent program for organising and controlling references for use with LaTeX. It also allows you to add notes on a paper and create a .bib file for submission to some journals.

Installation

MACTEX distribution: `https://tug.org/mactex/downloading.html`
TEXSHOP: `http://pages.uoregon.edu/koch/texshop/obtaining.html`. Then follow the installation instructions at `http://pages.uoregon.edu/koch/texshop/installing.html`.
JABREF: `http://jabref.sourceforge.net/download.php`.

3 Python distribution

Python is fast becoming the coding language of choice over older languages such as IDL and Fortran. Your mac should come with a python distribution, but you may want to install additional packages, such as Astropy, which contains many different useful astronomy-related modules. The easiest way to install and update Python packages is using pip, available at `https://pip.pypa.io/en/latest/installing.html`.
Alternatively, Astropy is included by default in the python installation in the UREKA package.
If you are setting up from scratch, ipython may not be installed. If you are using

Python 2.7, make sure you install the correct version of iPython.
-Setup easy_install if you haven't already. It can be downloaded from `http://mrtopf.de/blog/en/a-small-introduction-to-python-eggs/` , `python ez_setup.py`, then `sudo easy_install ipython-0.13-py2.7.egg`
This ensures the correct ipython is used.

4 Miscellaneous Software I've Found Useful

4.1 TOPCAT

Tool for OPerations on Catalogues And Tables (TOPCAT) is an excellent table viewing and plotting program. It can be used to catalogue match, concatenate tables, create new columns from existing, and quickly plot large amounts of data. You can also convert the format of a table easily (e.g., from .fits to IPAC) and calculate basic statistics.

Installation

`www.star.bris.ac.uk/~mbt/topcat/#osx` dmg file. If you are going to be viewing and plotting large amounts of data, consider also increasing the amount of memory TOPCAT can use on your computer. Instructions at `www.star.bris.ac.uk/~mbt/topcat/faq.html#macFlags`

4.2 GAIA

Useful visualisation tool similar to DS9. It is particularly good for viewing and collapsing data cubes.

Installation

All instructions are included in the thread at `http://stackoverflow.com/questions/18215185/how-to-install-and-run-gaia-astronomical-software-from-starlink-hikianali`
If you are using a bash shell, you will need to edit your .bashrc file, to set an alias so your computer knows where to find GAIA when you want to open it. If you are using C shell, you will need to edit your .cshrc file. Nano is an easy terminal-based text editor that can be used to do this:
`$ nano ~/.bashrc`, then add the required lines and save. You may need to `$ sudo nano ~/.bashrc` if permission is denied when you attempt to save changes.
Update New 2015 version for Yosemite & El Capitan `http://starlink.eao.hawaii.edu/starlink/2015ADownload`

4.3 Dropbox

Handy for backing up work to multiple devices, and sharing files with collaborators

Installation

`https://www.dropbox.com/install`

4.4 Stellarium

Extremely useful free software planetarium. Can be used for planning observing runs, checking object visibility and amateur astronomy.

Installation

`http://www.stellarium.org/en_GB/`

Appendix A - Installation of Scisoft

Download Scisoft from `scisoftosx.dyndns.org`. The Intell version (latest is for 10.8, but works for Mavericks)
Follow the installation instructions on the same web page.
Edit your .bashrc file with the following (this will be slightly different for C shell):
`. /usr/local/scisoft/bin/setup.bash`
To make IRAF:
Choose a directory for your IRAF login.cl file e.g., Documents/IRAF
To make IRAF compile properly, you will need to edit a small amount of code in the extern.pkg file located in directory/usr/local/scisoft/packages/iraf/iraf/unix/hlib.
1) cd to this location.
2) Make a copy of extern.pkg somewhere where you have write access (e.g. Documents)
3) Make the following change to this file
Change `if (!defvar("helpdb")) {` to
`if (defvar("helpdb") == no) {`
4) Rename extern.pkg in directory/usr/local/scisoft/packages/iraf/iraf/unix/hlib to something else (e.g., extern2.pkg)
5) Move your edited extern.pkg back to directory/usr/local/scisoft/packages/iraf/iraf/unix/hlib.

This workaround fixes the bug that stops IRAF from compiling. cd back to the directory with your login.cl file and `mkiraf`. After starting an xgterm (`xgterm &`), you should be able to start IRAF with `ecl`.

Appendix B - Installing Ureka

1)Follow the instructions at `http://ssb.stsci.edu/ureka/dev/docs/installation.html`
Then, if you are on Mavericks or Yosemite, follow the instructions at `https://obiwant.wordpress.com/2014/03/25/installing-ureka-on-macbookpro-with-os-x-maverick comment-page-1/#comment-43`

Useful Astronomy Webpages

NED: `http://ned.ipac.caltech.edu/`
Look up any extragalactic object by name, or position. Contains useful information including object RA, dec, redshift, magnitudes, diameters and a list of articles that have referenced this object.

ADS: `http://adsabs.harvard.edu/default_service.html`
Search for all astronomy-related articles by author name of keyword.

Ned Wright's cosmology calculator: `http://www.astro.ucla.edu/~wright/CosmoCalc.html`
Can be used to calculate a number of cosmological values at a given redshift with user input cosmological constants.

Object Visibility: `http://catserver.ing.iac.es/staralt/`
Enter observatory and time of the year with object coordinates and a plot is created showing object rise and set times, along with distance from zenith, airmass, and moon separation. Essential in planning an observing run.

ArXiv: http://arxiv.org/list/astro-ph/new
List of all new astronomy papers updated daily,

SDSS quick view: `http://skyserver.sdss3.org/public/en/tools/chart/navi.aspx?ra=44.3889437874415&dec=41.5164287572009`
Enter your RA and dec, and if within SDSS bounds, will show a pretty colour image of your galaxy.