"PUSH TO"

An effective, low cost alternative to Digital Setting Circles and Go To systems.

Agenda

- Overview
- Astronomical Coordinate Systems
- Terms and Definitions
- Design
- Implementation
- Configurations and Examples
- Q & A

Overview

Through the incorporation of a push-to system, we are, in effect, manually reproducing the automated process used by “go to” and Digital Setting Circle systems such as Meade’s AutoStar, Celestron’s SkyAlign, Orion’s Intelliscope, and Sky Engineering’s Sky Commander.

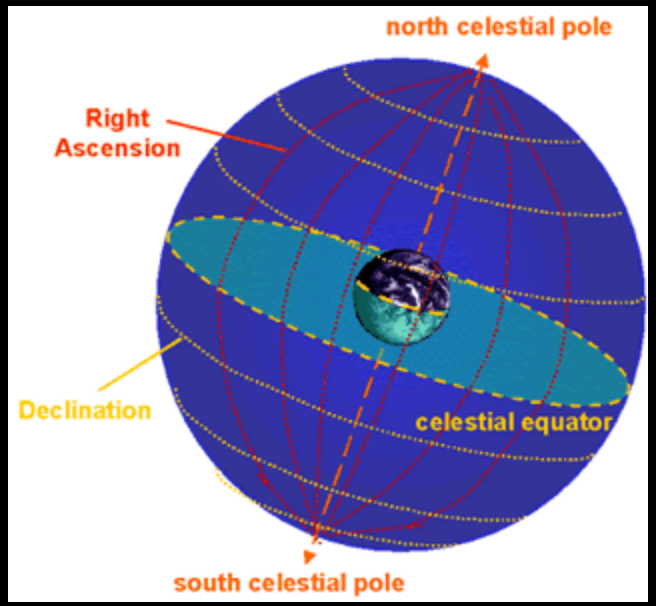
Astronomical Coordinate Systems

- Equatorial
- Ecliptic
- Galactic
- Horizontal

Astronomical Coordinate Systems

EQUATORIAL

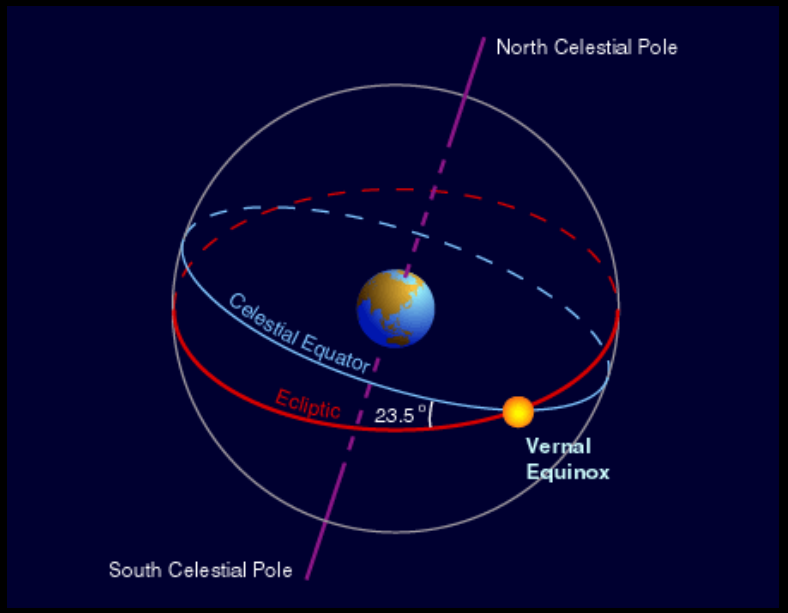
The equatorial coordinate system is a method of mapping objects by projecting the Earth's geographic poles and equator onto the sky, or celestial sphere. The projected equator is called the celestial equator and the project poles are called the celestial poles.



Astronomical Coordinate Systems

ECLIPTIC

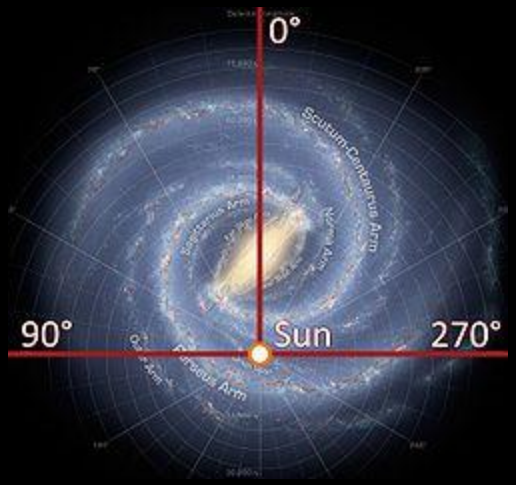
The term ecliptic refers to the apparent path that the Sun follows through the sky over the course of the year. Specifically, this refers to the day to day motion of the Sun when it is observed at the same time each day. It does not refer to the hour by hour motion of the Sun as the Earth rotates.



Astronomical Coordinate Systems

GALACTIC

The galactic coordinate system, or GCS, is centered on the Sun and aligned with the center of the Milky Way galaxy. The northern galactic pole is located in Coma Bernices and the southern celestial pole is in Sculptor.

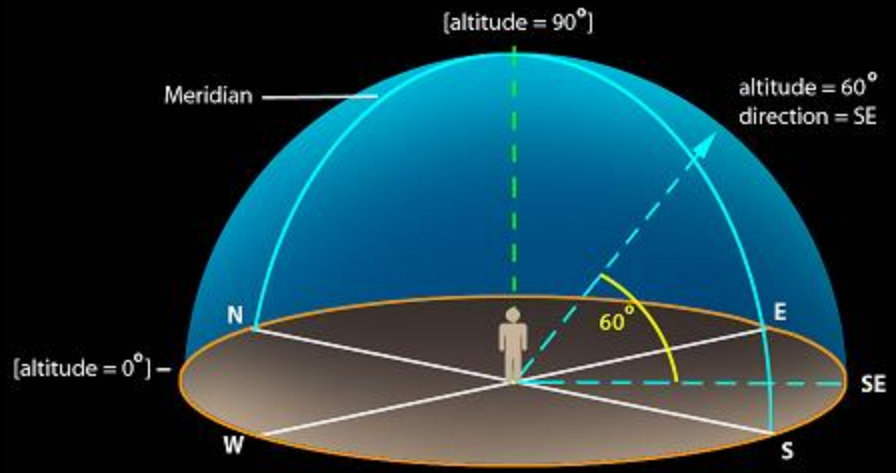


Astronomical Coordinate Systems

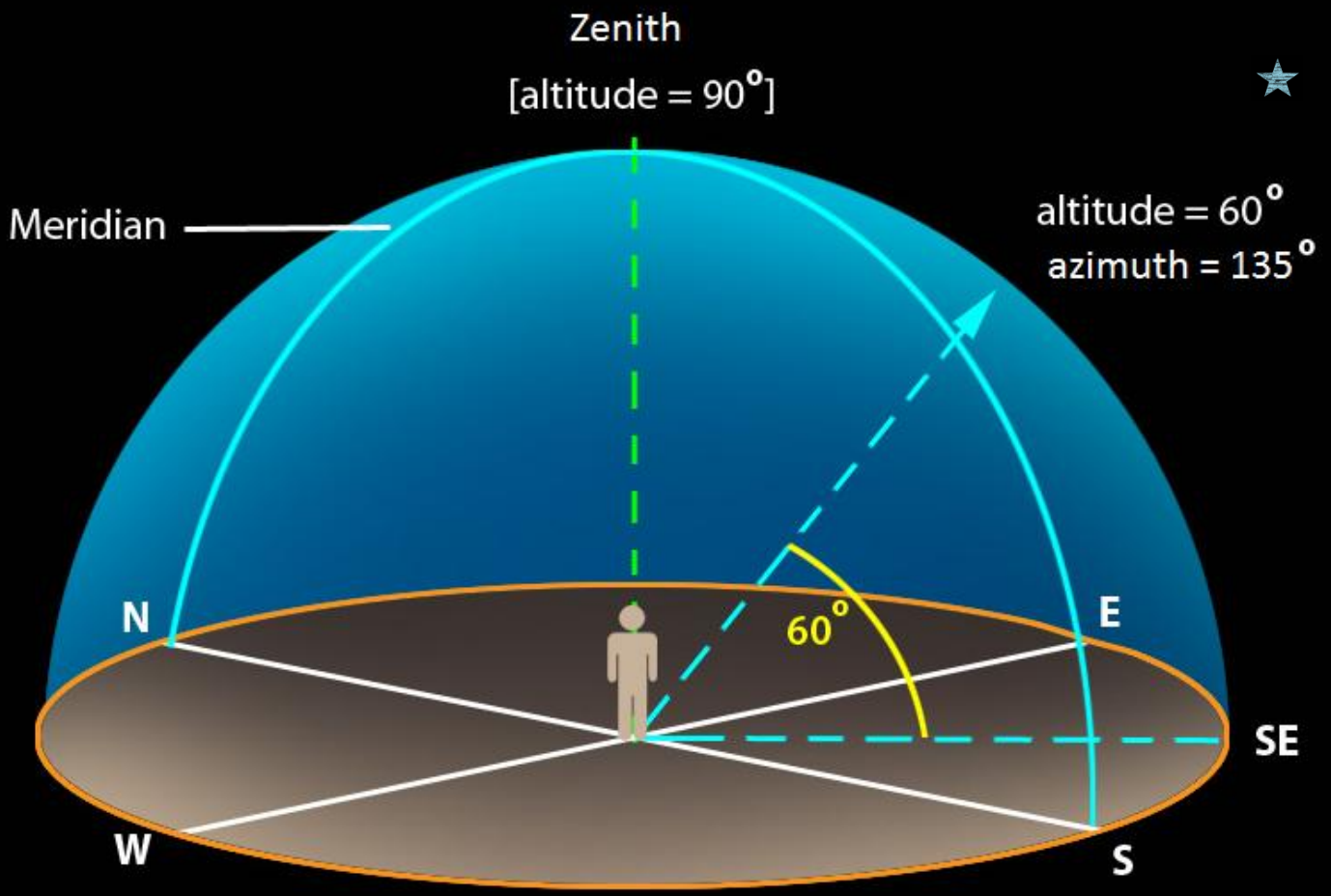
HORIZONTAL

Referred to as 'Alt/Az coordinates', this system of celestial coordinates is dependent on the observer's latitude and longitude. The position of an object on the celestial sphere at a particular time is given by its altitude, or the angular distance above the horizon, and the azimuth, or the angular distance measured from North to East.

The horizontal coordinate system depends on the location of the observer and the time of the observation. This coordinate system is fixed to the Earth rather than the stars and therefore, unlike in the equatorial coordinate system, the coordinate of an object changes with time.



Terms and Definitions



Terms and Definitions

- Altitude
- Azimuth
- Cardinal Points
- Zenith

Terms and Definitions

Altitude:

The vertical angle of an object relative to the position of the observer, represented by a value between 0 and 90 degrees. A value of 0 represents the horizon, while a value of 90 represents a point directly overhead.

Terms and Definitions

Azimuth:

The horizontal angle of an object relative to the position of the observer, represented by a value between 0 and 359 degrees.

If you were in the Boy Scouts and earned your Orienteering merit badge, you probably had to “shoot an azimuth.”

Terms and Definitions

Cardinal Points:

Each of the four main points of the compass (North, South, East, West).

Terms and Definitions

Zenith:

The point in the sky that is directly above the observer.

Design

Components:

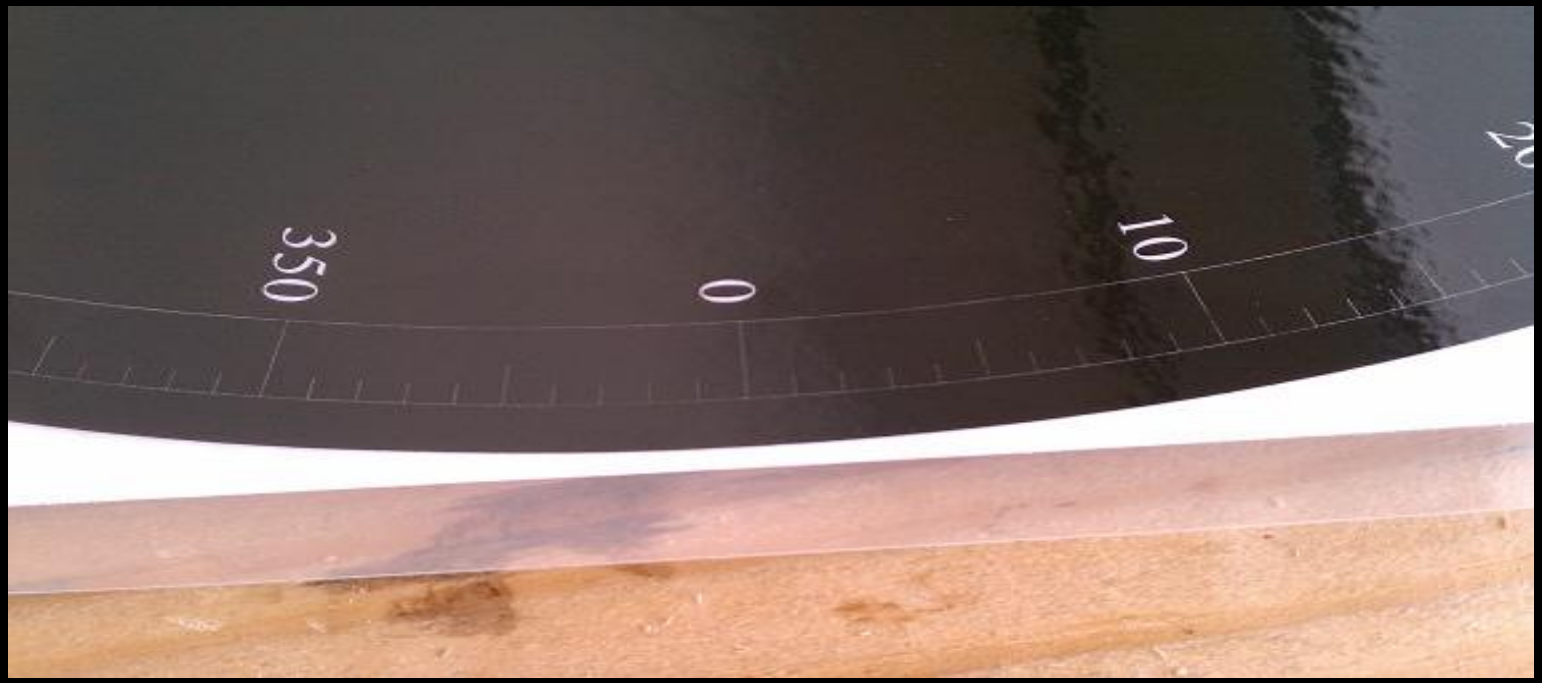
- Telescope
- Degree Circle
- Digital Level or Carpenter's Compass Pointer
- Source for Alt/Az Coordinates

Design

Telescope…more is always better!

Design

Degree Circle



Design

Degree Circle

Web site to create degree circles:
http://settingcircles.robertwillett.com/

Generates a vector PDF that can be printed and laminated at Kinko's, or "tiled" and printed on your home printer and taped together. Cost to print and laminate a 24" degree circle on "good paper" at FedEx/Kinko's was $15.00.

Design

Digital Level or Carpenter's Compass

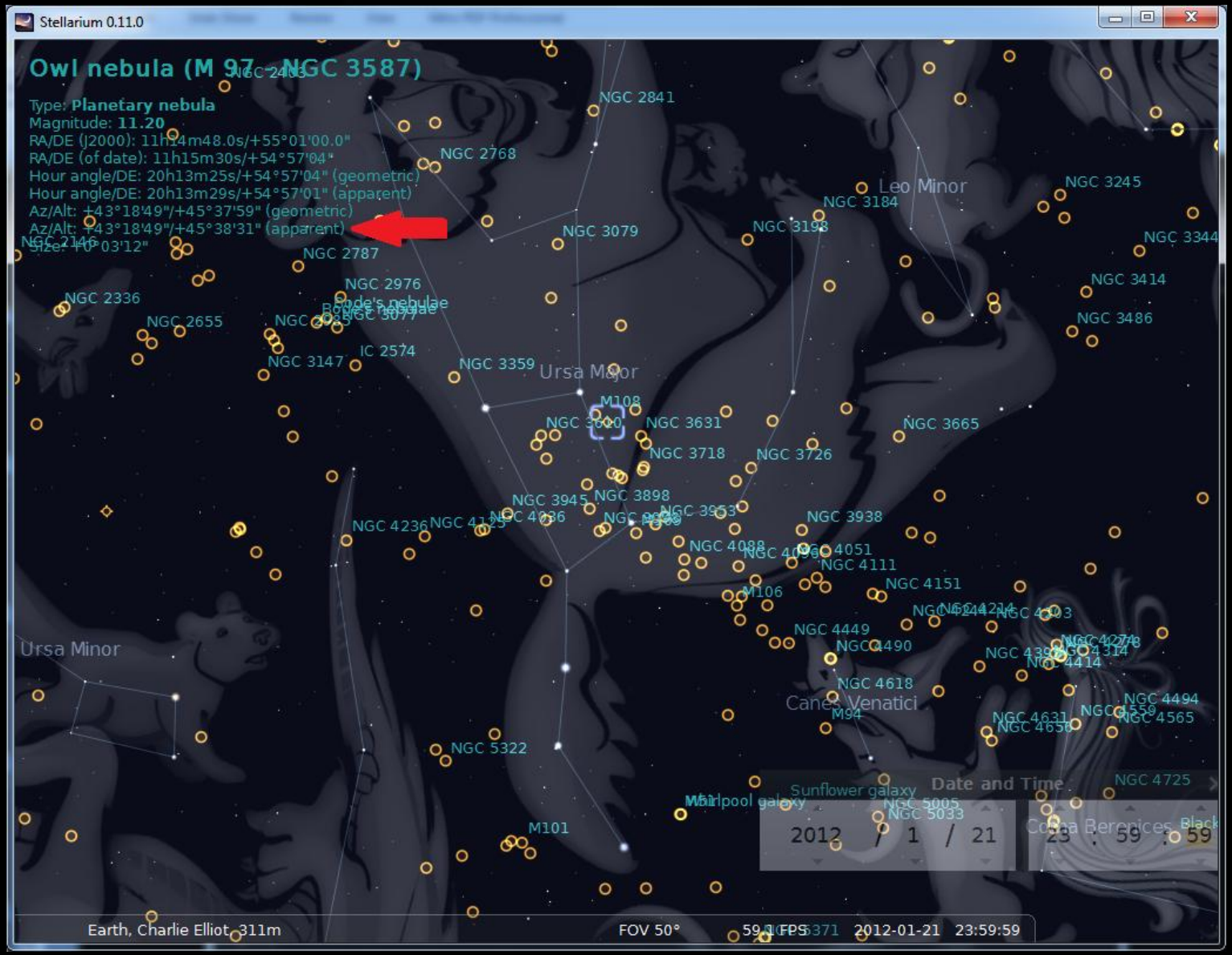
Design

Pointer

Implementation

Source for Alt/Az Coordinates

- Stellarium (Windows, Linux, Mac)
- Sky Safari (iOS and Android 2.2+)
- Distant Suns (iOS)
- WhereIsIt? (Android 2.2+)
- AstroTools (Android 2.2+)
- SkEye (Android 2.2+)
- SkyMap (Windows Phone 7)


Stellarium 0.11.0
Owl nebula (M 97 - NGC 3587)
Type: Planetary nebula
Magnitude: 11.20
RA/DE (J2000): 11h14m48.0s/+55°01'00.0"
RA/DE (of date): 11h15m30s/+54°57'04"
Hour angle/DE: 20h13m25s/+54°57'04" (geometric)
Hour angle/DE: 20h13m29s/+54°57'01" (apparent)
Az/Alt: +43°18'49"/+45°37'59" (geometric)
Az/Alt: +43°18'49"/+45°38'31" (apparent)
Size: +0°03'12"
NGC 2403
NGC 2841
NGC 2768
NGC 3079
NGC 2787
NGC 2976
NGC 2336
NGC 2655
NGC 3077
NGC 3147
IC 2574
NGC 3359
Ursa Major
M108
NGC 3631
NGC 3718
NGC 3726
NGC 3665
NGC 3945
NGC 3898
NGC 3953
NGC 3938
NGC 4236
NGC 4088
NGC 4051
NGC 4111
NGC 4151
M106
NGC 4449
NGC 4490
NGC 4618
Canes Venatici
M94
NGC 4631
NGC 4565
NGC 5322
M51
M101
Ursa Minor
Leo Minor
NGC 3184
NGC 3198
NGC 3245
NGC 3344
NGC 3414
NGC 3486
Sunflower galaxy
Whirlpool galaxy
NGC 5005
NGC 5033
Coma Berenices
NGC 4725
Date and Time
2012 / 1 / 21
23 : 59 : 59
Earth, Charlie Elliot, 311m
FOV 50°
2012-01-21 23:59:59

Implementation

Source for Alt/Az Coordinates

What if I don't have a smart phone or a tablet or I just don't want to bring my laptop outside?

Implementation

Source for Alt/Az Coordinates

Alignment Star	Alt	Az	Object	Alt	Az	Alt Adj	Az Adj
Mirak (Ursa Minor)	47.28	41.00	The Owl Nebula (M97)	45.63	43.3	-1.65	2.3

* Coordinates represent the location of objects relative to John Wood Astronomy Field on 01/21/2012 at 23:59:59.

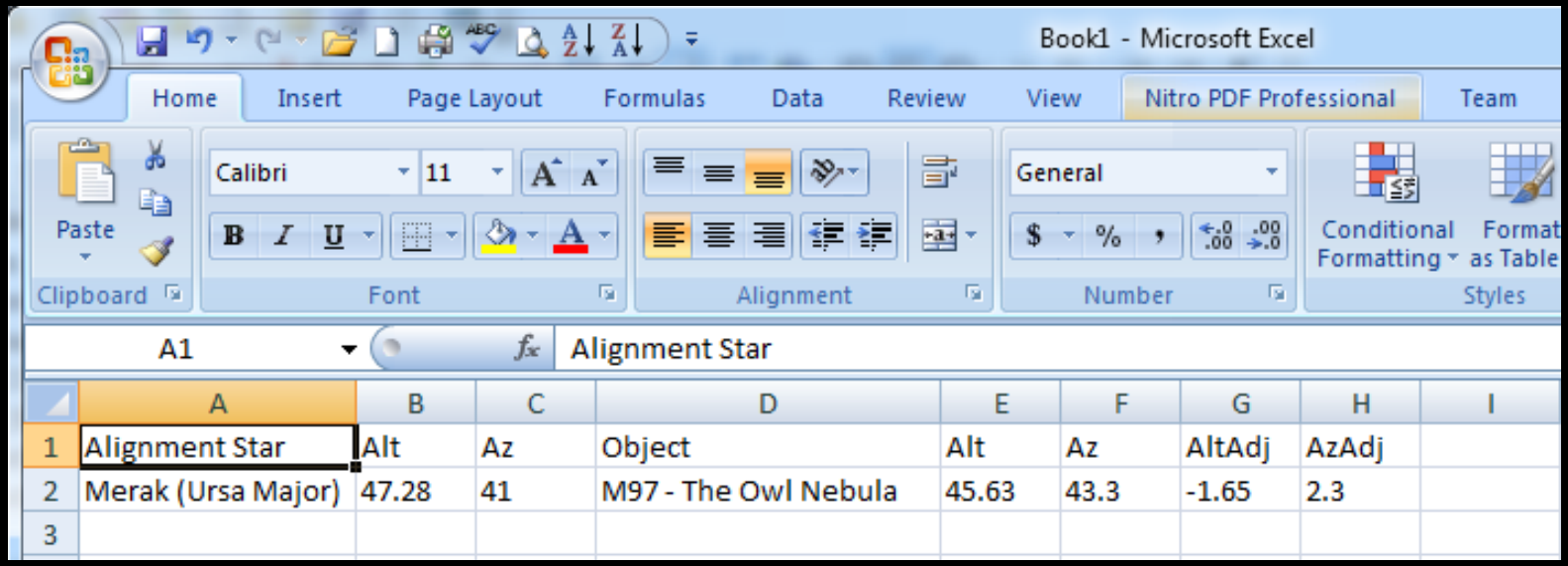
Implementation

- Tip:

  If you're set up next to someone with a "go to" scope, ask them for the altitude and azimuth coordinates of the object they're observing.

Implementation

- Tip:
  …or use a spreadsheet like this one…



	A	B	C	D	E	F	G	H	I
1	Alignment Star	Alt	Az	Object	Alt	Az	AltAdj	AzAdj	
2	Merak (Ursa Major)	47.28	41	M97 - The Owl Nebula	45.63	43.3	-1.65	2.3	
3									

Implementation

The end result…

Configurations and Examples

Refractor on a DIY Alt/Az Mount

Used with permission, CloudyNights.com

Configurations and Examples

Orion VersaGo II Alt/Az Mount

Used with permission, CloudyNights.com

Configurations and Examples

Meade Lightbridge with custom base

Used with permission, CloudyNights.com

Configurations and Examples

Binos on a DIY Alt/Az Parallelogram Mount

Used with permission, CloudyNights.com

Configurations and Examples

Instead of an inclinometer, use a protractor

Used with permission, CloudyNights.com

Configurations and Examples

Old school DOS … DobPC running on an HP

Used with permission, CloudyNights.com

“Apps”

Sky Safari

By far, the most comprehensive astronomy app available. Available for Android and iOS, Sky Safari includes the entire NGC, IC, Caldwell, and Messier catalogs as well as planets, minor planets, asteroids, comets, and man made satellites. The database also includes extensive information about each celestial object. The “Pro” version includes telescope control via a wifi adapter available from Orion and Southern Stars.

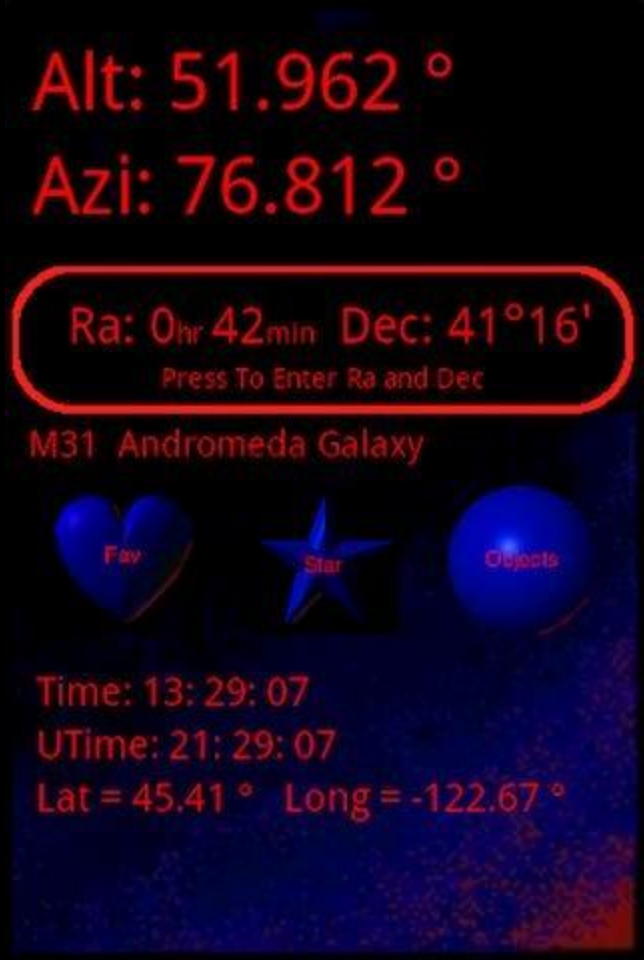
…also the most expensive.

“Apps”

Whereisit

A no-frills app that includes the entire Messier catalog, a few stars, and some of the brighter Caldwell objects. Provides only the altitude and azimuth coordinates.

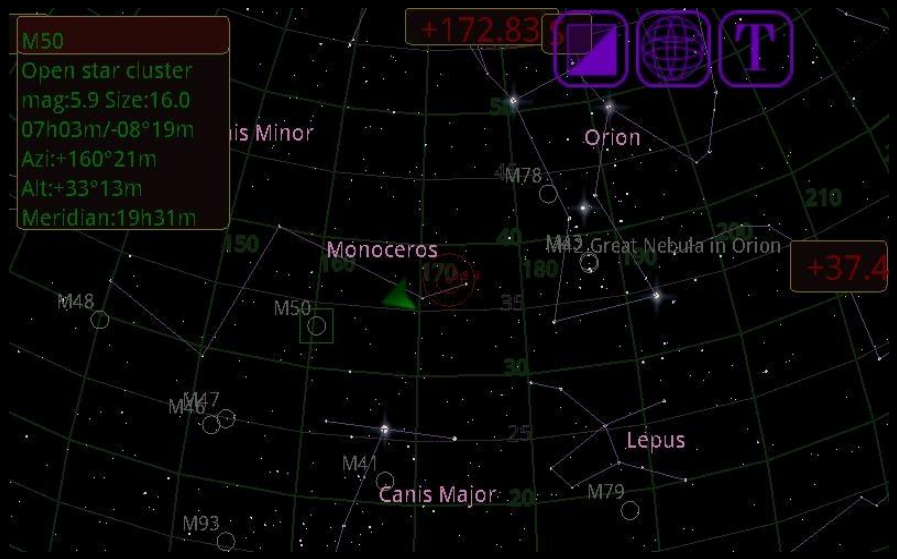
…and it’s free!



“Apps”

Astro-Tools

Available only for Android, not very pretty and the user interface is a bit clunky, but it has the biggest database of all of the astronomy apps with the exception of Sky Safari.



…and it’s free!

“Apps”

Mobile Planetarium

A less expensive alternative to Sky Safari includes the Messier catalog, selected NGC and Caldwell objects, brighter comets and asteroids, and a handful of stars.

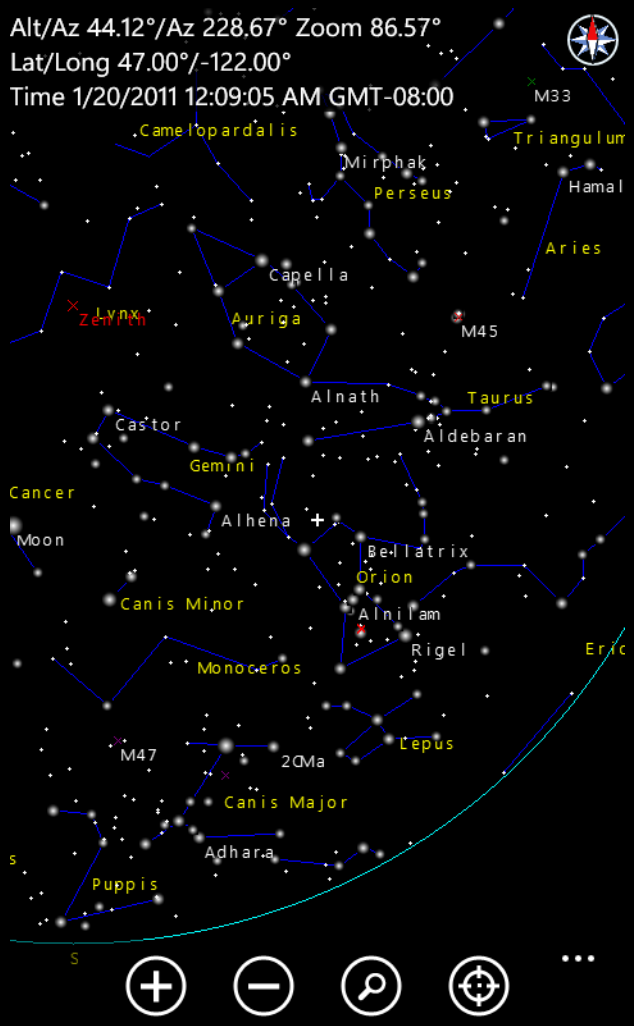
The cost is under $3.00.

“Apps”

SkyMap

A Windows Phone 7 alternative to Sky Safari, includes the Messier catalog, selected NGC objects, and over 100,000 stars. Intended to be used as a planetarium application rather than an observing application, but still works well for this particular purpose.

The cost is under $1.49.



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