A-Team Tutorials Introduction

Background

The Slooh Research Group (SRG) was set up in 2012 to coordinate the activities of members wishing to use the Slooh.com telescopes for scientific work. In 2013, Tony Evans and Don Cranford Jr. were instructed by Norm Pritchett on the techniques required to submit asteroid astrometry to the Minor Planet Centre (MPC). Notes taken at that time have evolved into this set of tutorials and the asteroid observers at Slooh eventually christened themselves the A-Team.

There is nothing about observing asteroids and comets that is super-complicated, but there are a lot of small things to think about so please work your way through the tutorials and practice the exercises.

Principles

There are a couple of principles that we should observe:

1. The Minor Planet Centre (MPC) is a serious scientific organisation with some big responsibilities. When I last looked, it had 510 million observations of over one million objects spanning 215 years. Every day the MPC receives thousands of observations from professional and amateur observers, so strict quality controls must be applied. While the MPC welcomes (and needs) amateur observations, they must be of a quality comparable to those from professional observing teams.

2. Slooh.com is a commercial organisation that seeks to provide access to, and education about, astronomy for a wide range of age groups and astronomical experience. Slooh supports members who wish to make observations and submit them to scientific organisations but needs to ensure that these observations are of a high quality that will reflect well on Slooh and its members. To that end, members wishing to submit measurements to the MPC and other astronomical organisations need to pass through a period of “apprenticeship” to develop and demonstrate the necessary skills.

It is an objective of the A-Team to help Slooh members complete this “apprenticeship” and to achieve the “graduation” that will allow them to submit measurements of asteroids and comets to the MPC.

General Documentation

There are a couple of documents published by the MPC that provide guidance on observing minor bodies and submitting reports. It is strongly advised that the newcomer read these and become familiar with the content. If some of the topics are as yet unfamiliar to you, do not worry. Help will be available each step of the way to becoming an observer.

- MPC Guide to Minor Body Astrometry is the basic introduction by the MPC.
- MP EC 2011-E67 is an editorial seeking to improve observing and reporting practice.

There are many books, articles and papers that can be found on the internet, addressing all aspects of asteroid and comet observing. In these notes we will focus on the particular use of the Slooh telescopes.

When observing asteroids or comets there is normally a "workflow" of activities to perform. The tutorials contain a description of each activity in sequence.

Workflow

Targets & Priorities

Firstly, identify some target asteroids to observe. You can build a "candidates list" of objects that may be worth observing now or in the near future. Initially, select relatively bright and slow-moving objects to practice on. Later targets will be more challenging and include newly discovered Near-Earth-Objects (NEOs), Potentially Hazardous Asteroids (PHAs) and comets.

This activity involves using online resources or planetarium software to determine what objects are currently visible and whether observations are needed.

Visibility & Missions

Check which of your potential targets are currently visible using available mission slots of a suitable Slooh telescope. Obtain details of its coordinates and set up the missions. Multiple missions are needed to show the movement of objects over time.

This activity involves using an "ephemeris" (a list showing the position in the sky of an object at different times) and using the Slooh reservation system to set up missions.

Identify & Measure

There are two software applications available that will measure the positions of asteroids in an image. You will need to choose one of them (more information later).

FITS images are downloaded from Slooh and loaded you're your chosen software. "Data Reduction" (also known a "Plate Solving") matches the pattern of stars in an image to the stars in a catalogue. The software can then check for known objects in the field of view (FOV) and make astrometric (position) and photometric (magnitude) measurements.

This activity involves installing and configuring the chosen software, and developing the skill to use it to obtain accurate measurements.

Quality & Residuals

A "residual" is the difference between your measured position and the position predicted by the object's orbital elements. By calculating residuals, we can assess the quality of our observations and decide whether they should be reported to the MPC.

Find_Orb is the software used to calculate orbits and residuals. For your initial objects, it will be enough to upload your observations to the online version of Find_Orb but eventually you may need to install the PC version and use it to generate orbital elements from observations.

Reports & Publications

When your observations and measurements are of a good standard you will be able to report them to the MPC. The report is produced by your chosen software and sent to the MPC website.

Once you are qualified to submit observation reports you will want to know that they have been accepted and published. Several types of publication and online databases can be monitored, and your observations will appear in all of them. Observations of an important NEO will appear in less than 24 hours while those for a well-known main belt asteroid can take a few weeks.

Levels

The tutorials are organised in 3 "Levels".

Level 1 – Introductory

This consists of running through the workflow with relatively easy targets. The main objective is to ensure you can identify targets, set up missions and use the software to measure the position and magnitude of objects.

Level 2 – Intermediate

This includes finding more scientifically interesting and challenging targets that require observations. The objects may be fainter, or faster moving, and will require different measurement techniques.

During Level 2 you will submit your first observations to the MPC.

Level 3 – Graduate

Additional types of targets are introduced including as-yet-unconfirmed discoveries from the NEOCP (Near Earth Object Confirmation Page) and PCCP (Potential Comet Confirmation Page). Special techniques are introduced for measuring the position and magnitude of "fuzzy" comets.

The procedures required to report new discoveries are introduced.

Once members have demonstrated the ability to produce quality reports for a range of object types, they "graduate" and are free to

conduct a program of observations individually or as part of a Slooh group.

Conclusions

Observing asteroids and comets is a fascinating activity and can be of genuine scientific value. It is not particularly difficult but does require time and attention to detail. The Slooh.com A-Team programme can provide support and assistance to develop your skills as an observer.

If you are interested in participating, and have not already done so, contact Paul Cox (paul@slooh.com) and ask to join the A-Team Asteroid Monitoring group. Let him know your level of experience and particular areas of interest and you can soon become a qualified observer.

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