Data Mining
Astronomical Images - 2

Paul Mortfield
Data Mining Astronomical Images - 2

How to obliterate discoveries during image processing but were afraid to ask

- Beyond the pretty picture
- Supernovae
- Blink before you combine
- Case Study – 2009UG20
- Tools & Resources
NGC185
Bernhard Hubl

Beyond the Pretty Picture
Variables in M5
Bernhard Hubl
Photometry

DY-Peg

Time since JD 2454709.5 (August 31, 2008 UT)
LCROSS

LCROSS 5 km

LCROSS ~435,000 km

LCROSS 20090629 05:23 UT
P.Mortfield Sierra Remote Observatories
LCROSS and M12
~560,000 km
Supernovae

April 9, 2006

NGC 3953
Bill Gardner

SN2006bp
April 20, 2006
01:11 UT
P.Mortfield

IAU Circulars: cfa-www.harvard.edu/iau/cbat.html
www.supernovae.net/supernova.html
NGC 7479 – Al Kelly
October 24, 2009

SN2009jf
SN 2007sr

Don Goldman & Paul Mortfield
SN2008hj – Puckett, Briggs, Newton
Discovery Nov 20, 2008 at mag 17.2
What if you think you’ve found a supernova?

- Is it in multiple frames?
- Offset telescope and reshoot
- Check POSS images
- Check other online images
- IAU needs confirmation image from another source

or join Tim Puckett’s Supernova Search Program

www.cometwatch.com
Comet McNaught
C/2005 L3

NGC 5033 – Stuart Heggie
June 24, 2009
NGC 5033 + Comet McNaught
Paul Mortfield
June 26, 2009

+2 hrs
+3 hrs
Blink before you Combine

ASTEROID

(3507) Vilas mag 17.4
19 asteroids in a single 30 arcmin field
October 22, 2009
Searching for old asteroid
Found 1 new uncataloged

Data:
- Sierra Remote Obs.
- RCOS 16” f/8.9
- Apogee U16M CCD
- Paramount-ME
- Astrodon G2 Lum Filter
- 30’ x 30’ FOV
- Exposure 15min. Bin 2x2
- Limiting magnitude: ~21.2
Straight Summed
Plate solve for astrometry

COD  G80
OBS  P. Mortfield
MEA  P. Mortfield
TEL  0.4-m f/8.9 Ritchey-Chretien + CCD
ACK  MPC091026a file updated 2009.10.26 02:20:16
AC2  pMortfield@solar.stanford.edu
NET  USNO-B1.0

FUZ901  C2009  10  22.48186  04  08  21.05  +33 15  48.7  G80
FUZ901  C2009  10  22.49271  04  08  20.65  +33 15  45.7  G80
FUZ901  C2009  10  22.50360  04  08  20.35  +33 15  42.4  G80
FUZ901  C2009  10  22.51451  04  08  20.03  +33 15  40.0  G80

- Maxim - Pinpoint
- CCDSoft – TheSky
- AIP4WIN
- Astrometrica
MaximDL – Pinpoint LE
MPChecker

Minor Planet Checker - your best friend!!

Date: 2009 10 22.5 UT

Produce list of known minor planets around:

- this J2000.0 position: R.A. = 04 08 20 Decl. = +33 15 42

or around these observations:

Radius of search = 20 arc-minutes
Limiting magnitude = 23
Observatory code = G80

Default = 500

http://scully.harvard.edu/~cgi/CheckMP
MPChecker/CMTChecker/NEOChecker/NEOCMTChecker

Here are the results of your search(es) in the requested field(s):

The following objects, brighter than $V = 23$, were found in the 25.0-arcminute region around R.A. = 04 08 20, Decl. = +33 15 42 (J2000.0) on 2009 10 22 50 UT:

<table>
<thead>
<tr>
<th>Object designation</th>
<th>R.A.</th>
<th>Decl.</th>
<th>V</th>
<th>Offsets</th>
<th>Motion/min</th>
<th>Orbit</th>
<th>Further observations?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>h m s</td>
<td></td>
<td></td>
<td>R.A. Decl.</td>
<td>R.A. Decl.</td>
<td></td>
<td>Comment</td>
</tr>
<tr>
<td>2009 US2D</td>
<td>04 08 20.5</td>
<td>+33 15 41</td>
<td>20.0</td>
<td>0.1E</td>
<td>0.0N</td>
<td>0.3-</td>
<td>0.2-</td>
</tr>
<tr>
<td>2008 US1</td>
<td>04 07 26.3</td>
<td>+33 27 13</td>
<td>20.4</td>
<td>11.2E</td>
<td>11.5N</td>
<td>0.3-</td>
<td>0.1+</td>
</tr>
<tr>
<td>(37759) 1997 EL36</td>
<td>04 07 03.3</td>
<td>+33 28 51</td>
<td>18.5</td>
<td>16.0W</td>
<td>13.1N</td>
<td>0.3-</td>
<td>0.1+</td>
</tr>
<tr>
<td>2003 SC322</td>
<td>04 09 40.0</td>
<td>+33 03 26</td>
<td>19.7</td>
<td>10.4E</td>
<td>12.2S</td>
<td>0.3-</td>
<td>0.3+</td>
</tr>
<tr>
<td>2004 CF11</td>
<td>04 08 38.6</td>
<td>+33 53 30</td>
<td>20.7</td>
<td>3.9E</td>
<td>22.2S</td>
<td>0.4-</td>
<td>0.1+</td>
</tr>
<tr>
<td>2006 AC105</td>
<td>04 09 58.4</td>
<td>+33 27 39</td>
<td>20.8</td>
<td>20.6E</td>
<td>12.0N</td>
<td>0.3-</td>
<td>0.1+</td>
</tr>
<tr>
<td>2007 DM55</td>
<td>04 08 40.6</td>
<td>+33 39 16</td>
<td>22.0</td>
<td>4.3E</td>
<td>23.6N</td>
<td>0.4-</td>
<td>0.1+</td>
</tr>
</tbody>
</table>

Number of objects checked = 458613
Get new object coordinates

New Object Ephemeris Generator

Use the form below to generate ephemerides for your new objects prior to the assignment of official provisional designations. You enter at least two observations (in the normal MPC format) for each object into the form below. The observations of each object can be on the same night. Up to 100 observations may be entered on this form. Then select Generate ephemerides to obtain the ephemerides. Observations that are not formatted correctly will be rejected. Ensure that there is a Carriage Return at the end of the last observation.

Enter observations below (a guide is included to allow manual entry of the data on those platforms that do not allow cut-and-paste operations):

<table>
<thead>
<tr>
<th>Object</th>
<th>Date</th>
<th>RA</th>
<th>Dec</th>
<th>RA</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>FU2901</td>
<td>C2009 10</td>
<td>22.46186</td>
<td>04 08 21.05</td>
<td>+33 15 48.7</td>
<td>G80</td>
</tr>
<tr>
<td>FU2901</td>
<td>C2009 10</td>
<td>22.45271</td>
<td>04 08 20.65</td>
<td>+33 15 45.7</td>
<td>G80</td>
</tr>
<tr>
<td>FU2901</td>
<td>C2009 10</td>
<td>22.50360</td>
<td>04 08 20.35</td>
<td>+33 15 42.4</td>
<td>G80</td>
</tr>
<tr>
<td>FU2901</td>
<td>C2009 10</td>
<td>22.51451</td>
<td>04 08 20.03</td>
<td>+33 15 40.0</td>
<td>G80</td>
</tr>
</tbody>
</table>

By default, ephemerides are geocentric, begin "now" and are for 7 days at 1 day intervals. The desired start date for the ephemeris should be entered in YYYY MM DD format, e.g., 2000 June 7 = 2000 06 07. Note that these ephemerides are intended to assist current observations only.

Observatory code: G80
Start date for ephemeris: 2009 10 26
Number of ephemeris positions to output: 24
Ephemeris interval: 1 days
Display ephemeris positions in: ○ truncated sexagesimal or ○ full sexagesimal or ○ decimal units
Display motions as: ○ /sec, ○ /min, ○ /hr or ○ /day.
○ Total motion and direction ○ Separate R.A. and Decl. motions

Generate ephemerides Clear/reset form
Submit 2 nights of observations and wait (patiently)

<table>
<thead>
<tr>
<th>CODE</th>
<th>G80</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBS</td>
<td>P. Mortfield</td>
</tr>
<tr>
<td>MEA</td>
<td>P. Mortfield</td>
</tr>
<tr>
<td>TEL</td>
<td>0.4-m f/8.9 Ritchey-Chretien + CCD</td>
</tr>
<tr>
<td>ACK</td>
<td>MPC091026a file updated 2009.10.26 02:20:16</td>
</tr>
<tr>
<td>AC2</td>
<td><a href="mailto:pMortfield@solar.stanford.edu">pMortfield@solar.stanford.edu</a></td>
</tr>
<tr>
<td>NET</td>
<td>USNO-B1.0</td>
</tr>
</tbody>
</table>

| FUZ901 * | C2009 10 22.48186 04 08 21.05 +33 15 48.7 |
| FUZ901   | C2009 10 22.49271 04 08 20.65 +33 15 45.7 |
| FUZ901   | C2009 10 22.50360 04 08 20.35 +33 15 42.4 |
| FUZ901   | C2009 10 22.51451 04 08 20.03 +33 15 40.0 |
| FUZ901   | C2009 10 26.22488 04 06 26.23 +32 56 33.0 |
| FUZ901   | C2009 10 26.23244 04 06 25.97 +32 56 31.3 |
| FUZ901   | C2009 10 26.23999 04 06 25.76 +32 56 29.5 |
| FUZ901   | C2009 10 26.24758 04 06 25.49 +32 56 26.9 |

----- end -----

Email: mpc@cfa.harvard.edu

18hrs later received temporary designation

2009 UG20
Obtain an MPC Observatory Code

• The guidelines and basics:
  www.cfa.harvard.edu/iau/info/Astrometry.html
• Choose 2 or 3 well known (mag 10-14) asteroids
• Image them over two different nights
• Perform astrometric data reduction
• Create properly formatted MPC report
• Mail attached MPC report to: mpc@cfa.harvard.edu
  Turn off email HTML, Text msgs only
• Wait patiently to receive new MPC Observatory Code
**Resources**

Obtain an MPC observatory Code:

www.cfa.harvard.edu/iau/info/Astrometry.html

IAU Minor Planet Center:

www.cfa.harvard.edu/iau/mpc.html

Latest Supernovae:

www.rochesterastronomy.org/supernova.html

Visible Comets:

cometchasing.skyhound.com

www.aerith.net/comet/weekly/current.html

Palomar Observatory Sky Survey (POSS):

archive.stsci.edu/cgi-bin/dss_form

JPL Horizons object ephemeris

ssd.jpl.nasa.gov/horizons.cgi
David Dunlap Observatory
Largest telescope in Canada back in action

www.thedDO.ca
Images Courtesy:

Stef Cancelli
Bill Gardner
Robert Gendler
Don Goldman
Stuart Heggie
Kerry Anne Hepburn
Bernhard Hubl
Al Kelly
Fred & Katrina Lum
Daniel Marquardt
Jim Misty
Greg Morgan
Benoit Schillings
Thank You AIC

Paul@theDDO.ca