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Chapter 1

Contents

1.1 Introduction

SCAMP\(^1\) (Software for Calibrating AstroMetry and Photometry) is a computer program that computes astrometric projection parameters from source catalogues derived from FITS (Flexible Image Transport System)\(^2\) images. The computed solution is expressed according to the WCS\(^3\) standard. The main features of SCAMP are:

- Compatibility with SExtractor\(^4\) FITS or Multi-Extension FITS catalogue format in input,
- Generation of WCS-compliant and SWarp\(^5\)-compatible FITS image headers in output,
- Automatic grouping of catalogues on the sky
- Selectable on-line astrometric reference catalogue
- Automatic determination of scale, position angle, flipping and coordinate shift using fast pattern-matching
- Various astrometric calibration modes for single detectors and detector arrays
- Combined astrometric solutions for multi-channel/instrument surveys
- Highly configurable astrometric distortion polynomials
- Correction for differential chromatic refraction
- Proper motion measurements
- Multi-threaded code that takes advantage of multiple processors.
- VOTable\(^6\)-compliant XML (eXtensible Markup Language)\(^7\) output of meta-data.
- XSLT (eXtensible Stylesheet Language Transformations)\(^8\) filter sheet provided for convenient access to metadata from a regular web browser.

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\(^1\) \url{http://astromatic.net/software/scamp}
\(^2\) \url{http://fits.gsfc.nasa.gov}
\(^3\) \url{http://www.atnf.csiro.au/people/mcalabre/WCS/index.html}
\(^4\) \url{http://astromatic.net/software/sextractor}
\(^5\) \url{http://astromatic.net/software/swarp}
\(^6\) \url{http://www.ivoa.net/documents/VOTable}
\(^7\) \url{http://en.wikipedia.org/wiki/XML}
\(^8\) \url{http://en.wikipedia.org/wiki/XSLT}
1.2 Installing the software

1.2.1 Hardware requirements

SCAMP runs in (ANSI) text-mode from a shell. A window system is not necessary for basic operation.

The amount of memory required depends mostly on the size of the input catalogues and on the number of exposures and astrometric “contexts” (stable instruments) involved in the astrometric solution. Each detection in the input catalogues amounts to about 140 bytes, plus a few tens of kbytes for every FITS table. To this one should add the memory space used by the normal equation matrix, which is $8 \times N_T^2$ bytes, with, in the default SCAMP configuration,

$$N_T = N_{\text{ast}} \times N_{\text{arr}} \times N_{P_{\text{arr}}} + (N_{\text{exp}} - N_{\text{ast}}) \times N_{P_{\text{foc}}},$$

where $N_{\text{arr}}$ is the number of focal plane arrays (extensions) in each exposure, $N_{P_{\text{arr}}}$ the number of polynomial terms describing the static distortion pattern of each array (20 for a 3rd order in $x$ and $y$), $N_{P_{\text{foc}}}$ the number of polynomial terms for the exposure-dependent focal plane distortion pattern, and $N_{\text{exp}}$ the number of exposures. Actually one should probably double the memory space used by the normal equation matrix to account for buffers in the ATLAS library. It is not uncommon to see memory usage amounting to gigabytes when many large mosaic exposures are involved. For instance, computing an astrometric solution with $N_{\text{arr}} = 60$ and $N_{P_{\text{foc}}} = 6$ for a set of 500 exposures of a 60-CCD camera, each with 10,000 detections, spread over three runs and five bands, may consume as much as 8GB of memory.

Although multiple CPU cores are not required for running SCAMP, they can dramatically reduce execution time, especially when the solution is computed over a large number of exposures.

1.2.2 Obtaining SCAMP

For Linux users, the simplest way to have SCAMP up and running is to install the standard binary package the comes with your Linux distribution. Run, e.g., `apt-get scamp` (on Debian) or `dnf scamp` (Fedora) and SCAMP, as well as all its dependencies, will automatically be installed. If you decided to install the package this way you may skip the following and move straight to the next section.

However if SCAMP is not available in your distribution, or to obtain the most recent version, the SCAMP source package can be downloaded from the official GitHub repository. One may choose one of the stable releases, or for the fearless, a copy of the current master development branch.

1.2.3 Software requirements

SCAMP has been developed on GNU/Linux machines and should compile on any POSIX-compliant system (this includes Apple OS X and Cygwin on Microsoft Windows, at the price of some difficulties with the configuration), provided that the development packages of the following libraries have been installed:

- **ATLAS** V3.6 and above,
- **FFTw** V3.0 and above.

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9 https://github.com/astromatic/scamp
10 https://github.com/astromatic/scamp/releases
11 https://github.com/astromatic/scamp/archive/master.zip
12 http://en.wikipedia.org/wiki/Linux
14 http://www.apple.com/osx
15 http://www.cygwin.com
16 http://www.microsoft.com/windows
17 http://math-atlas.sourceforge.net
25 Use the `--with-atlas` and/or `--with-atlas-incdir` options of the SCAMP configure script to specify the ATLAS library and include paths if ATLAS files are installed at unusual locations.
26 Make sure that FFTw has been compiled with `configure` options `--enable-threads` `--enable-float`. 

• PLPlot\(^{19}\) V5.9 and above.

On Fedora/Redhat distributions for instance, the development packages above are available as atlas-devel, fftw-devel and plplot-devel. PLPlot is only required for producing diagnostic plots. Note that ATLAS and FFTW are not necessary if SCAMP is linked with Intel\(^{20}\)’s MKL (Math Kernel Library)\(^{20}\) library.

### 1.2.4 Installation

To install from the GitHub source package, you must first uncompress the archive:

```
$ unzip scamp-<version>.zip
```

A new directory called scamp-<version> should now appear at the current location on your disk. Enter the directory and generate the files required by the autotools\(^{21}\), which the package relies on:

```
$ cd scamp-<version>
$ sh autogen.sh
```

A configure script is created. This script has many options, which may be listed with the --help option:

```
$ ./configure --help
```

No options are required for compiling with the default GNU C compiler (gcc) if all the required libraries are installed at their default locations:

```
$ ./configure
```

Compared to gcc and the libraries above, the combination of the Intel\(^{20}\) compiler (icc) and the MKL\(^{22}\) libraries can give the SCAMP executable a strong boost in performance, thanks to better vectorized code. If icc and the MKL are installed on your system\(^{27}\), you can take advantage of them using

```
$ ./configure --enable-mkl
```

Additionally, if the SCAMP binary is to be run on a different machine that does not have icc and the MKL installed (e.g., a cluster computing node), you must configure a partially statically linked executable using

```
$ ./configure --enable-mkl --enable-auto-flags --enable-best-link
```

In all cases, SCAMP can now be compiled with

```
$ make -j
```

An src/scamp executable is created. For system-wide installation, run the usual

```
$ sudo make install
```

You may now check that the software is properly installed by simply typing in your shell:

```
$ scamp
```

which will return the version number and other basic information (note that some shells require the rehash command to be run before making a freshly installed executable accessible in the execution path).

\(^{19}\) http://www.plplot.org

\(^{20}\) http://software.intel.com/intel-mkl

\(^{21}\) http://en.wikipedia.org/wiki/GNU_Build_System

\(^{22}\) http://software.intel.com/intel-mkl

\(^{27}\) The Linux versions of the Intel\(^{20}\) compiler and MKL are available for free to academic researchers, students, educators and open source contributors.
1.3 Using SCAMP

SCAMP is run from the shell with the following syntax:

```
$ scamp Catalog1 [Catalog2 ...] -c configuration-file [-Parameter1 Value1 - Parameter2 Value2 ...]
```

The parts enclosed within brackets are optional. The file names of input catalogues can be directly provided in the command line, or in lists that are ASCII files with each catalogue name preceded by @ (one per line). One should use lists instead of the catalogue file names if the number of input catalogues is too large to be handled directly by the shell. Any -Parameter Value statement in the command-line overrides the corresponding definition in the configuration file or any default value (see below).

1.3.1 Input files

Catalogues

Catalogues read by SCAMP must be in SExtractor’s “FITS_LDAC” binary format. It is strongly advised to use SExtractor version 2.4.4 or later. The catalogues must contain all the following measurements in order to be processable by SCAMP:

- Centroid coordinates. They must be specified with the CENTROID_KEYS configuration parameter (default: XWIN_IMAGE and YWIN_IMAGE).
- Centroid error ellipse, as defined by the CENTROIDERR_KEYS configuration parameter (default: ERRWIN_IMAGE, ERRBWIN_IMAGE and ERRTHETAWIN_IMAGE).
- Factors controlling astrometric distortion. These are set with the DISTORT_KEYS configuration parameter (default: XWIN_IMAGE and YWIN_IMAGE).
- Flux measurements, defined by the PHOTFLUX_KEY configuration parameter (default: FLUX_AUTO).
- Flux uncertainties, defined by the PHOTFLUXERR_KEY configuration parameter (default: FLUXERR_AUTO).

In addition, it is strongly advised (but not mandatory) to include the following optional SExtractor measurements:

- FLAGS, FLAGS_WEIGHT and/or IMAFLAGS_ISO flags for filtering out blended and corrupted detections.
- the FLUX_RADIUS half-light radius estimation for filtering out both small glitches and extended objects.
- ELONGATION to help filtering out objects such as trails and diffraction spikes
- a measurement of the object “spread” compared to that of the PSF model: SPREAD_MODEL and its uncertainty SPREADERR_MODEL. These measurements are not used by SCAMP for selection, but they get propagated to the output catalogues.

.ahead

Header files

The binary catalogues in “FITS_LDAC” format read by SCAMP contain a copy of the original FITS image headers. These headers provide fundamental information such as frame dimensions, World Coordinate System (WCS) data and many other FITS keywords which SCAMP uses to derive a full astrometric and photometric calibration. It is often needed to change or add keywords in some headers. Editing FITS files is not convenient, so SCAMP provides read (and write) support for “external” header files. External headers may either be real FITS header cards (no carriage-return), or ASCII files containing lines in FITS-like format, with the final line starting with the “END” keyword. Multiple extensions must be separated by an “END” line. External “headers” need not contain all the FITS keywords normally required. The keywords present in external headers are only there to override their counterparts in the original image headers or to add new ones.

29 http://astromatic.net/software/sextractor
Hence for every input (say, xxxx.cat) FITS catalogue, SCAMP looks for a xxxx.ahead header file, loads it if present, and overrides or adds to image header keywords those found there. .ahead is the default suffix; it can be changed using the AHEADER_SUFFIX configuration parameter.

It is often useful to add/modify the same FITS keyword(s) in all input catalogues. SCAMP offers the possibility to put these keywords in one single external header file, which is read before all other .ahead files (but after reading the catalogue headers). The name of this file is scamp.ahead by default; it can be changed using the AHEADER_GLOBAL configuration parameter. show an example of a typical .ahead file

1.3.2 Output files

.head header files

SCAMP itself generates FITS header keywords, containing updated astrometric and photometric information. These keywords are written in ASCII to external header files, with the .head filename extension by default (the suffix can be changed with the HEADER_SUFFIX configuration parameter). In combination with the original image files, these .head headers are ready to be used by the SWarp\(^{30}\) image stacking tool\(^{[1]}\).

The astrometric engine at the heart of SCAMP and SWarp is based on Mark Calabretta’s WCSLIB\(^{31}\) library\(^{[2][3]}\), to which we added support for the TPV description of polynomial distortions\(^{35}\). All celestial coordinate computations are performed in the equatorial system, although galactic and ecliptic coordinates are supported in input and output.

Output catalogues

SCAMP can save three kinds of catalogues: local copies of the reference catalogues downloaded from the Vizier server (see §[chap:astref]), a "merged", calibrated version of input catalogues (§[chap:mergedcat]), and a “full” calibrated version of input a reference catalogues (§[chap:fullcat]).

Diagnostic files

Two types of files can be generated by SCAMP, providing diagnostics about the calibrations:

- Check-plots are graphic charts generated by SCAMP, showing scatter plots or calibration maps. The CHECKPLOT_TYPE and CHECKPLOT_NAME configuration parameters allow the user to provide a list of check-plot types and file names, respectively. A variety of raster and vector file formats, from JPEG to Postscript, can be set with CHECKPLOT_DEV. PNG is the default. See the CHECKPLOT section of the configuration parameter list below for details.

- An XML\(^{32}\) file providing a processing summary and various statistics in VOTable\(^{33}\) format is written if the WRITE_XML switch is set to Y (the default). The XML_NAME parameter can be used to change the default file name scamp.xml. The XML file can be displayed with any recent web browser; the XSLT\(^{34}\) stylesheet installed together with SCAMP will automatically translate it into a dynamic, user-friendly web-page. For more advanced usages (e.g., access from a remote web server), alternative XSLT translation URLs may be specified using the XSL_URL configuration parameter.

1.3.3 The Configuration file

Each time it is run, SCAMP looks for a configuration file. If no configuration file is specified in the command-line, it is assumed to be called scamp.conf and to reside in the current directory. If no configuration file is found, SCAMP uses its own internal default configuration.

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\(^{30}\) http://astromatic.net/software/swarp

\(^{31}\) http://www.atnf.csiro.au/people/mcalabre/WCS/wcslib

\(^{35}\) The TPV description was originally proposed by E. Greisen

\(^{32}\) http://en.wikipedia.org/wiki/XML

\(^{33}\) http://www.ivoa.net/documents/VOTable

\(^{34}\) http://en.wikipedia.org/wiki/XSLT
Creating a configuration file

`SCAMP` can generate an ASCII dump of its internal default configuration, using the `-d` option. By redirecting the standard output of `SCAMP` to a file, one creates a configuration file that can easily be modified afterward:

```
$ scamp -d >scamp.conf
```

A more extensive dump with less commonly used parameters can be generated by using the `-dd` option.

Format of the configuration file

The format is ASCII. There must be only one parameter set per line, following the form:

```
Config-parameter Value(s)
```

Extra spaces or linefeeds are ignored. Comments must begin with a `#` and end with a linefeed. Values can be of different types: strings (can be enclosed between double quotes), floats, integers, keywords or Boolean (`Y/y` or `N/n`). Some parameters accept zero or several values, which must then be separated by commas. Values separated by commas, spaces, tabs or linefeeds may also be read from an ASCII file if what is given is a filename preceded with `@` (e.g. `@values.txt`). Integers can be given as decimals, in octal form (preceded by digit `O`), or in hexadecimal (preceded by `0x`). The hexadecimal format is particularly convenient for writing multiplexed bit values such as binary masks. Environment variables, written as `$HOME` or `${HOME}` are expanded.

Configuration parameter list

Here is a list of all the parameters known to `SCAMP`. Please refer to next section for a detailed description of their meaning. Some “advanced” parameters (indicated with an asterisk) are also listed. They must be used with caution, and may be rescoped or removed without notice in future versions.

and M. Calabretta in a 2000 draft, but abandoned in later versions [4]. Following adoption in `SCAMP` and in large data processing centers it eventually became a registered FITS convention in 2012 [36], and is now included in recent versions of the `WCSLIB`.

1.4 Output Catalogues

`SCAMP` is run from the shell with the following syntax:

1.4.1 Merged Catalogues

In addition to astrometric header information, `SCAMP` can write out “merged” catalogues (one per field group). These catalogues contain the calibrated coordinates and magnitudes of a union of all detections from input catalogues that passed the `SCAMP` acceptance criteria (S/N, flags). Merged coordinates and magnitudes are computed using a weighted average of all overlapping measurements, and are accompanied by estimates of formal errors and 1-sigma uncertainties on individual measurements. The `MERGEDOUTCAT_TYPE` configuration parameter sets the format of the merged catalogue; it is set to `NONE` by default, which means that no catalogue is created. The available formats are ASCII (pure ASCII table), ASCII_HEAD (ASCII table with a small header describing the column content), and FITS_LDAC (FITS binary table). FITS_LDAC is the recommended format; FITS_LDAC files are smaller, carry the data with full precision, and can be read with popular software such as `fv` and `TOPCAT`. They can be converted to ASCII format with the `ldactoasc` command-line utility, which is part of the `SExtractor` package.

The columns present in the file are:

```
Name SOURCE_NUMBER
```

<table>
<thead>
<tr>
<th>Name</th>
<th>Content</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPOS_TOTAL</td>
<td>Total number of overlapping positions</td>
<td></td>
</tr>
<tr>
<td>NPOS_OK</td>
<td>Number of overlapping positions kept for astrometry</td>
<td></td>
</tr>
<tr>
<td>ALPHA_J2000</td>
<td>(Weighted-)average Right-Ascension</td>
<td>deg</td>
</tr>
<tr>
<td>DELTA_J2000</td>
<td>(Weighted-)average Declination</td>
<td>deg</td>
</tr>
<tr>
<td>ERRA_WORLD</td>
<td>Position uncertainty (RMS) along major world axis (may include additional uncertainty computed by SCAMP)</td>
<td>deg</td>
</tr>
<tr>
<td>ERRB_WORLD</td>
<td>Position uncertainty (RMS) along minor world axis (may include additional uncertainty computed by SCAMP)</td>
<td>deg</td>
</tr>
<tr>
<td>ERRTHETA_WORLD</td>
<td>Position angle of error ellipse (CCW/world-x) (The current estimation of error ellipse parameters is still done very crudely)</td>
<td>deg</td>
</tr>
<tr>
<td>DISPALPHA_J2000</td>
<td>Measured dispersion (RMS) of position along Right-Ascension</td>
<td>deg</td>
</tr>
<tr>
<td>DISPDELTA_J2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Content</td>
<td>Unit</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>PMALPHA_J2000</td>
<td>Measured dispersion (RMS) of position along Declination</td>
<td>deg</td>
</tr>
<tr>
<td>PMDELA_J2000</td>
<td>Apparent proper motion along Right-Ascension</td>
<td>mas/yr</td>
</tr>
<tr>
<td>PMALPHAERR_J2000</td>
<td>Proper motion uncertainty (RMS) along Right Ascension</td>
<td>mas/yr</td>
</tr>
<tr>
<td>PMDELAERR_J2000</td>
<td>Proper motion uncertainty (RMS) along Declination</td>
<td>mas/yr</td>
</tr>
<tr>
<td>PARALLAX_WORLD</td>
<td>Trigonometric parallax</td>
<td>mas</td>
</tr>
<tr>
<td>PARALLAXERR_WORLD</td>
<td>Trigonometric parallax uncertainty</td>
<td>mas</td>
</tr>
<tr>
<td>CHI2_ASTROM</td>
<td>Reduced chi2 per d.o.f. of the proper motion/parallax fit</td>
<td>–</td>
</tr>
<tr>
<td>EPOCH</td>
<td>(Astrometrically-)weighted-average of observation dates</td>
<td>yr</td>
</tr>
<tr>
<td>EPOCH_MIN</td>
<td>Earliest observation date</td>
<td>yr</td>
</tr>
<tr>
<td>Name</td>
<td>Content</td>
<td>Unit</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>EPOCH_MAX</td>
<td>Latest observation date</td>
<td>yr</td>
</tr>
<tr>
<td>NMAG</td>
<td>Number of magnitude measurements in each photometric instrument</td>
<td>-</td>
</tr>
<tr>
<td>MAG</td>
<td>Vector of (ux-weighted-)average magnitudes</td>
<td>mag</td>
</tr>
<tr>
<td>MAGERR</td>
<td>Vector of magnitude uncertainties</td>
<td>mag</td>
</tr>
<tr>
<td>MAG_DISP</td>
<td>Vector of measured magnitude dispersions (RMS)</td>
<td>mag</td>
</tr>
<tr>
<td>COLOR</td>
<td>Composite colour index computed by SCAMP</td>
<td>mag</td>
</tr>
<tr>
<td>SPREAD_MODEL</td>
<td>(Weighted-)average of &quot;SPREAD_MODEL&quot;'s</td>
<td>-</td>
</tr>
<tr>
<td>SPREADERR_MODEL</td>
<td>SPREAD_MODEL uncertainty</td>
<td>-</td>
</tr>
<tr>
<td>FLAGS_EXTRACTION</td>
<td>Arithmetic OR of SExtractor flags over overlapping detection</td>
<td>-</td>
</tr>
<tr>
<td>FLAGS_SCAMP</td>
<td>SCAMP flags for this detection</td>
<td>-</td>
</tr>
</tbody>
</table>
### 1.4.2 Full Catalogues

Other catalogues which can be produced by SCAMP are the “full” catalogues (one per field group). These catalogues contain the raw and calibrated coordinates and magnitudes of all individual detections that passed the SCAMP acceptance criteria. Each detection is linked to a parent source through to the SOURCE_NUMBER identifier, also present in the merged output catalogue. The CATALOG_NUMBER identifier link the detected source to its catalogue (as SCAMP could receive more than one input catalogue), CATALOG_NUMBER set to 0 being reserved to the reference catalogue. The FULLOUTCAT_TYPE configuration parameter sets the format of the full catalogue; the choice of options is the same as for MERGEDOUTCAT_TYPE.

The columns present in the file are:

<table>
<thead>
<tr>
<th>Name</th>
<th>Content</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOURCE_NUMBER</td>
<td>Source ID, the same as in “merged” catalogue</td>
<td>-</td>
</tr>
<tr>
<td>CATALOG_NUMBER</td>
<td>Catalogue ID, 0 being reserved to the reference catalogue</td>
<td>-</td>
</tr>
<tr>
<td>EXTENSION</td>
<td>FITS extension of the parent image (always set to 1 for single extension images)</td>
<td>-</td>
</tr>
<tr>
<td>ASTR_INSTRUM</td>
<td>Astrometric instrument (context) ID</td>
<td>-</td>
</tr>
<tr>
<td>PHOT_INSTRUM</td>
<td>Photometric instrument (context) ID</td>
<td>-</td>
</tr>
<tr>
<td>X_IMAGE</td>
<td>$x$ pixel coordinate of centroid</td>
<td>pixel</td>
</tr>
<tr>
<td>Y_IMAGE</td>
<td>$y$ pixel coordinate of centroid</td>
<td>pixel</td>
</tr>
<tr>
<td>ERRA_IMAGE</td>
<td>Position uncertainty (RMS) along major error ellipse axis</td>
<td>pixel</td>
</tr>
<tr>
<td><strong>Name</strong></td>
<td><strong>Content</strong></td>
<td><strong>Unit</strong></td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>ERRB_IMAGE</td>
<td>Position uncertainty (RMS) along minor error ellipse axis</td>
<td>pixel</td>
</tr>
<tr>
<td>ERRTHETA_IMAGE</td>
<td>Position angle of error ellipse (forced to 0 by current versions of SCAMP which isotropise input uncertainties.)</td>
<td>deg</td>
</tr>
<tr>
<td>ALPHA_J2000</td>
<td>Calibrated Right-Ascension of centroid in the ICRS (at epoch of observation)</td>
<td>deg</td>
</tr>
<tr>
<td>DELTA_J2000</td>
<td>Calibrated Declination of centroid in the ICRS (at epoch of observation)</td>
<td>deg</td>
</tr>
<tr>
<td>ERRA_WORLD</td>
<td>Position uncertainty (RMS) along major world axis (may include additional uncertainty computed by SCAMP)</td>
<td>deg</td>
</tr>
<tr>
<td>ERRB_WORLD</td>
<td>Position uncertainty (RMS) along minor world axis (may include additional uncertainty computed by SCAMP)</td>
<td>deg</td>
</tr>
<tr>
<td>ERRTHETA_WORLD</td>
<td>Position angle of error ellipse (CCW/world-x) (The current estimation of error ellipse parameters is still done very crudely)</td>
<td>deg</td>
</tr>
<tr>
<td>EPOCH</td>
<td>Julian date at start of observation</td>
<td>yr</td>
</tr>
<tr>
<td>MAG</td>
<td>Calibrated magnitude</td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Content</td>
<td>Unit</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>MAGERR</td>
<td>Magnitude uncertainty (may include additional uncertainty computed by SCAMP.)</td>
<td>mag</td>
</tr>
<tr>
<td>MAG_DISP</td>
<td>Vector of measured magnitude dispersions (RMS)</td>
<td>mag</td>
</tr>
<tr>
<td>SPREAD_MODEL</td>
<td>SPREAD_MODEL parameter</td>
<td></td>
</tr>
<tr>
<td>SPREADERR_MODEL</td>
<td>SPREAD_MODEL uncertainty</td>
<td></td>
</tr>
<tr>
<td>FLAGS_EXTRACTION</td>
<td>SExtractor flags</td>
<td></td>
</tr>
<tr>
<td>FLAGS_SCAMP</td>
<td>SCAMP flags for this detection</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 2

Indices and tables

- genindex
- modindex
- search


\textsuperscript{37} http://adsabs.harvard.edu/abs/2002ASPC..281..228B

\textsuperscript{38} http://adsabs.harvard.edu/abs/2002A&A...395.1061G

\textsuperscript{39} http://adsabs.harvard.edu/abs/2002A&A...395.1077C

\textsuperscript{40} http://adsabs.harvard.edu/abs/2004ASPC..314..551C