

Preface

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In this Preface...

Handbook Structure	2
Handbook Updates	3
Source Material & Attribution	3

The purpose of this *NOAO Data Handbook* is to describe the instruments and archived data products in enough detail that a Virtual Observatory user who is not familiar with them (or who may be new to the optical/infrared wavelength regime) can make informed use of these data products and services for scientific analysis. This *Handbook* is also intended for Principal Investigator teams who obtain data at NOAO or partner facilities and who wish to understand how their data are reduced and calibrated by the applicable pipelines. One of the key aims of this *Handbook* is to provide one-stop shopping for vital background material for each instrument, with references to more detailed material where it exists. It is also intended to be the most up-to-date reference material, and will be central to establishing the pedigree of datasets in the NOAO Science Archive (NSA). However, this *Handbook* is *not* intended to replace instrument manuals, online cookbooks, descriptions of filters, instrument design documents, or detailed technical descriptions of the archive or pipelines. It is also *not* a user guide for data analysis—the suite of available tools for data analysis is already quite rich, and growing. It will, however, draw upon all of these resources in order to provide a self-contained and complete manual for scientific use of the data from all instruments that are archived in the NSA. The complete list of the NSA holdings by instrument is given in Chapter 1.

The first edition of this *Handbook* coincided with the initial deployment of the End-to-End (E2E) data processing system at NOAO. E2E is the system that manages the flow of information and data from the database of approved observations, through data acquisition, transport from the telescope to an NOAO Archive Center, pipeline processing, and retrieval by an end-user. Because E2E was created *after* many instruments were deployed, rather than before, it will be

some time before the Archive is populated with all intended data products from all instruments. Thus, this *Handbook* is necessarily incomplete.

HANDBOOK STRUCTURE

This *Handbook* is relatively modular in its construction, and is organized conceptually into two parts: an introductory chapter that describes general properties of NOAO data and the means to identify and access data for retrieval from the NSA, and chapters containing reference material for each instrument or class of instruments. These latter chapters are intended to give users a concise overview of each instrument and a good understanding of the metadata and data products that are produced. Instrument chapters are organized identically at the section level and consist of the following topics:

- **Instrument Overview.** Each instrument is described in enough detail to acquaint the user with the basic design and configuration, capabilities, typical operation, and the associated vocabulary.
- **Data Products.** Each of the data products that are produced for an instrument (including file formats) and essential metadata (e.g., header keywords) are described in depth to enable their effective use.
- **Calibration.** A detailed description of the processing that occurs to produce each calibrated data product is presented, along with the mechanisms by which the calibration reference information (e.g., master bias frames, flat-fields, etc.) is created and applied.
- **Sources of Error.** This section describes the accuracies that can be expected of the data products (e.g., astrometric and photometric uncertainties), instrument peculiarities, anomalous conditions that may have occurred at one time or another, known data foibles, and any other limitations to the scientific use of the data products.
- **References and Further Information.** A list of contributing authors, cited references, and pointers to background information is provided at the end of each chapter. Novel uses of the data or useful processing and analysis techniques found in the literature may also be cited.

In addition to the material listed above, this *Handbook* contains a glossary of often used terms and acronyms.

Special notes appear throughout this *Handbook* to convey information of special interest or urgency, particularly for the casual reader. They are the following:



Informative notes are denoted with the light-bulb symbol, and generally contain tips and pointers that deserve special attention.



Cautionary notes are indicated like this, and indicate potential limitations of the data, the instrument, or the processing software that may affect the use or interpretation of the data products.



Warnings of serious consequences are indicated like this, and caution users of problems with the data that could lead to erroneous scientific interpretations, or problems with the software that could lead to errors that may not be apparent to users.

HANDBOOK UPDATES

New data products will be offered in the NOAO Science Archive in the future as new instruments are built and deployed at NOAO and partner facilities, as new processing pipelines are constructed to produce higher levels of data reduction for existing instruments, and as teams of scientists in the community create specialized products as a result of their research endeavors. Undoubtedly, improvements also will be made to the existing processing pipelines, and/or to the characterizations of instrument performance upon which the pipelines depend. When new or improved products are offered, chapters of this *Handbook* will be created or updated as necessary. This *Handbook* has been designed so that each chapter can be independently versioned, and updates will be announced on the NOAO Web pages and in the *NOAO/NSO Newsletter*. Users can download¹ the entire *Handbook* or any chapter of it as needed.

SOURCE MATERIAL & ATTRIBUTION

The source material for this *Handbook* was drawn from a large number of documents, including instrument manuals, instrument and software design documents, published papers, Web pages, data file headers, and informal conversations with many experts within and outside of NOAO. Often, figures, tables, and even text are taken directly from these sources. In order to keep the style and presentation of this *Handbook* relatively clean, the attribution to the source material is cited the first time it is used in the main body of each chapter.

1. from <http://www.archive.noao.edu/help.html>

The last section of each chapter is devoted to a listing of references, contributing authors, and background references to details that fall outside the scope of this document.