Astronomical Data Analysis Software and Systems IV
ASP Conference Series, Vol. 77, 1995
R. A. Shaw, H. E. Payne, and J. J. E. Hayes, eds.

The World Wide Web: Cornerstone of the EUVE Science Archive

K. McDonald, B. Stroozas, B. Antia, B. Roberts, K. Chen, N. Craig, and C. Christian

Center for EUV Astrophysics, University of California 2150 Kittredge Street, Berkeley, CA 94720–5030

Abstract. The Science Archive for the Extreme Ultraviolet Explorer (*EUVE*) satellite is using the World Wide Web (WWW) client/server software model as the cornerstone for the dissemination of *EUVE* archival material. A number of on-line services are available for accessing the large amounts of *EUVE* data that have been released publicly in the past year; additional services provide access to *EUVE*-related software and information. This paper outlines the current Archive WWW services and discusses plans for the future.

1. EUVE and the Science Archive

NASA's *Extreme Ultraviolet Explorer* (*EUVE*) satellite was launched on 1992 June 7. In the more than two years since, *EUVE* has performed exceedingly well, obtaining hundreds of gigabytes of scientifically invaluable data, which researchers will continue to analyze for years to come. Among the exciting early scientific results are the first complete EUV all-sky survey, the first EUV images of extended objects (e.g., the Moon, the Vela and Cygnus supernova remnants, and the Jupiter-Io plasma torus), and the first detection of helium on Mars.

The *EUVE* Science Archive at the Center for EUV Astrophysics (CEA) at the University of California, Berkeley, has been established to efficiently archive and disseminate to the public the large amounts of *EUVE* data and its associated software and documentation. The Archive has been actively working to implement innovative ideas and technologies, building the infrastructure to store and provide easy access to *EUVE* archival material. One such innovative idea is the use of the World Wide Web (WWW).

2. EUVE Science Archive WWW Services

The WWW provides a simple, fast, efficient, and user- and developer-friendly environment for the *global* dissemination of *EUVE* archival material. The CEA WWW site[1] offers a variety of Archive services for *EUVE* data, software, documentation, and general information, as detailed in the following sections.

[1] http://www.cea.berkeley.edu/HomePage.html

2.1. Data Services

One of the major functions of the Archive is to provide researchers with access to *EUVE* data. Proprietary data rights for *EUVE* observations began to expire in early 1994. In 1994 August, the data from the survey phase of the mission was released on the WWW via the following services:

- catalogs — In cooperation with NASA's Astrophysics Data System (ADS) project, the *EUVE* source catalogs (Malina et al. 1994; Bowyer et al. 1994; McDonald et al. 1994) have been installed in the new ADS WWW catalog service. This service provides users with immediate access to published scientific results on over 400 confirmed *EUVE* sources.

- source count rates — The *EUVE* Count Rate Service is a form-based service that analyzes the survey skymaps to search for any significant source detections near an input location. The count rate information for such detections are returned via e-mail to the user within hours of the request.

- skymaps — The *EUVE* Skymap Request Service is a form-based service that allows users to request small sections of the *EUVE* survey skymaps. After some initial processing based on the full skymaps at CEA, the requester is notified via e-mail within hours of the request that the FITS format skymap sections are available for pick-up in the CEA anonymous `ftp` site.

- "pigeonholes" — An *EUVE* pigeonhole is a file that contains the time-tagged information for photons within a small radius of a given position on the sky. The *EUVE* Pigeonhole Request Service is a form-based service that allows users to request *EUVE* pigeonholes. As with the skymaps above, the requester is notified via e-mail within a day or two of the request when the FITS Bintable format pigeonholes are available for pick-up in the CEA `ftp` site. This service is innovative in that *the requester is actually remotely accessing the raw EUVE telemetry and invoking the required processing to create the pigeonhole data products.*

- calibration data — In order to properly analyze *EUVE* pigeonholes, researchers require some supporting calibration data: instrument effective areas, vignetting maps, and point-spread functions, all of which are available on-line as FITS format files.

The proprietary data rights for the individual guest observer (GO) observations began to expire in 1994 April; additional data sets continue to be released on a monthly basis. Since the GO data sets typically require hundreds of MB of disk space to process and analyze, the Archive has developed the *EUVE* Spectral Data Browser service that allows users to browse, preview, and retrieve the public one-dimensional spectra. The spectral browser provides search capabilities (e.g., search by position and/or source classification) that enhance the usability of the browser by helping researchers quickly and easily locate those sources that match their particular interests. For those researchers requiring additional data for these observations (e.g., images, QPOE files, and telemetry tables), the full GO data sets may be ordered via WWW forms and are delivered on magnetic tape via postal mail.

Work is in progress to provide a variety of additional services including a complete standard set of skymap images, a standard set of pigeonholes for cataloged sources, more complete on-line access to the GO data sets (e.g., images and telemetry tables), and access to long-exposure imaging observations from the *EUVE* Right Angle Program (RAP—those observations taken concurrently during GO observations using the "scanning" telescopes, which are mounted at right angles to the GO spectrometers). Analysis services (e.g., light curves from pigeonhole data) are also under development.

2.2. Software Services

In addition to providing *EUVE* data, the Archive is committed to implementing various software services to complement the available data. The long-term goal is to serve as a "clearing-house" for software contributed by external users to support EUV-related research. Toward that end, the following tools are currently available:

- ISM transmission — Based on the model of Rumph, Bowyer, & Vennes (1994), this tool calculates the transmission of the interstellar medium (ISM) at EUV wavelengths.
- neutral hydrogen column density — Based on the published data of Fruscione et al. (1994) and Diplas & Savage (1994), this tool returns a table of neutral hydrogen (H I) column density information for the ten sources nearest to a given position.
- optically thin plasma spectra — This tool applies the Landini-Fossi X-ray/EUV spectral code (Landini & Fossi 1990) to create a spectrum for a specified emission measure, stellar distance, and interstellar H I, He I, and He II column density.

As this pool of unique utilities grows with contributions from the astronomical community, it will serve as a shared resource of useful software tools for researchers, fostering cooperation and enhancing the scientific return from the *EUVE* mission.

2.3. Information Services

A wide variety of documentation and information is also available to round out the public *EUVE* archival material. This material includes (1) general information on *EUVE*, CEA, and the Archive, (2) CEA publications, including the *EUVE* bibliography, journal and conference abstracts and papers, the special *EUVE* edition of the *Journal of the British Interplanetary Society* (JBIS, 1993), and past editions of the *EUVE* electronic newsletter, and (3) form-based services for such activities as ordering *EUVE* CD-ROMs and archival data sets or for contacting Archive personnel. Examples of some of the information services under development include a "meta-index" for the Archive and a Guest Investigator (GI) Program. The Archive meta-index will fully describe and link together all the public *EUVE* and associated data (e.g., finding charts and spectra from the optical identification program), providing an efficient and easy-to-use database containing all the available information for *EUVE* sources. The

GI program is being implemented to provide data analysis services to the research community by offering a standard package of support (e.g., computer access and scientific/technical personnel) to assist researchers in exploring the scientific potential of the *EUVE* data sets.

3. Summary

The *EUVE* Science Archive is using the WWW as the cornerstone for disseminating *EUVE* archival material. A wide variety of on-line electronic services provide access to large amounts of public *EUVE* data as well as to related software and information. As the project continues to mature, additional WWW services will be made available in order to assist the research community with the efficient and maximal use of *EUVE* data. For additional information, contact the Archive at the following address:

EUVE Science Archive
Center for EUV Astrophysics, University of California
2150 Kittredge Street, Berkeley, CA 94720–5030
510–642–3032 (voice) or 510–643–5660 (fax)

archive@cea.berkeley.edu
http://www.cea.berkeley.edu

Acknowledgments. The authors would like to thank Prof. Stuart Bowyer, Dr. Roger F. Malina, and the *EUVE* science team for their general support. Special thanks go to Bill Boyd and Steve Chan for their assistance in the Archive WWW efforts. This work has been supported by NASA contract NAS5–29298.

References

Bowyer, S., Lieu, R., Lampton, M., Lewis, J., Wu, X., Drake, J. J., & Malina, R. F. 1994, ApJS, 93, 569

Diplas, A., & Savage, B. D. 1994, ApJS, 93, 211

Fruscione, A., Hawkins, I., Jelinsky, P., & Wiercigroch, A. 1994, ApJS, 94, 127

JBIS 1993, Journal of the British Interplanetary Society, 46

Landini, M., & Monsignori Fossi, B. C. 1990, A&AS, 82, 229

Malina, R. F., Marshall, H. L., Antia, B., Christian, C. A., & Dobson, C. A. 1994, AJ, 107, 751

McDonald, K., Craig, N., Sirk, M. M., Drake, J. J., Fruscione, A., Vallerga, J. V., & Malina, R. F. 1994, AJ, 108, 1843

Rumph, T., Bowyer, S., & Vennes, S. 1994, AJ, 107, 2108