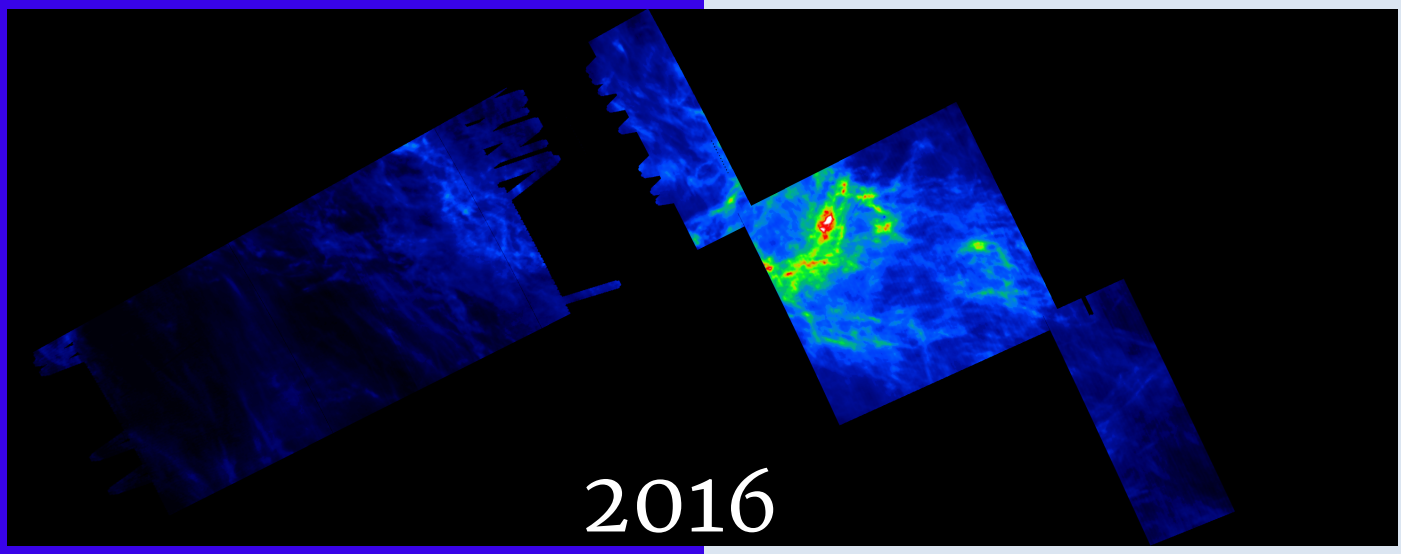


# 2016 Annual Report

## Astrophysics Source Code Library

# Table of Contents



Written by Alice Allen, ASCL Editor; March-April 2017

The cover image is an average of the central 10 velocity planes of a mosaic of five data cubes released as part of the Galactic Arecibo L-band Feed Array HI (GALFA-HI) survey (Peek et al., 2011, Ap J Suppl, 194, 20; DOI 10.1088/0067-0049/194/2/20; ADS Bibcode 2011ApJS..194...20P). The mosaic was created with computed version 4.0 of the Montage Image Mosaic Engine (ascl:1010.036). Image courtesy John Good and Bruce Berriman, California Institute of Technology.

## Background

The Astrophysics Source Code Library (ASCL), founded in 1999 by Robert Nemiroff (Michigan Technological University) and John Wallin (Middle Tennessee State University), is a free online registry for source codes of interest to astronomers and astrophysicists. All ASCL source codes have been used to generate results published in or submitted to a refereed journal. The ASCL website (http://ascl.net) is housed at Michigan Technological University; the site offers entries describing and linking to over 1400 source codes used in astronomy research, information about the resource itself and generally about research software, a news blog, and a discussion forum.

## 2016 Growth

The number of codes indexed in ASCL grew an average of 18.9 entries per month, up from the average growth of 17.0 codes per month over the 2013-2015 timeframe and the 17.1 codes per month average for 2015. 229 codes were added in 2016 but two were withdrawn, making total additions 227 for the year. At the end of December, the ASCL had 1406 code entries.

Submissions of codes by authors, and occasionally code users, have remained healthy; 57 of the 227 codes (25%) assigned IDs in 2016 were submitted using the online form. Thirteen codes submitted did not meet the criteria for inclusion in the ASCL.

In July 2014, the SAO/NASA Astrophysics Data System (ADS) started providing statistics for views of ASCL ADS records and clickthroughs from them to ASCL entries. These statistics indicate greater use of ASCL information over time from that resource; in the last half of 2016, ADS overtook Astronomy Picture of the Day (APOD) as the greatest source of referral traffic.

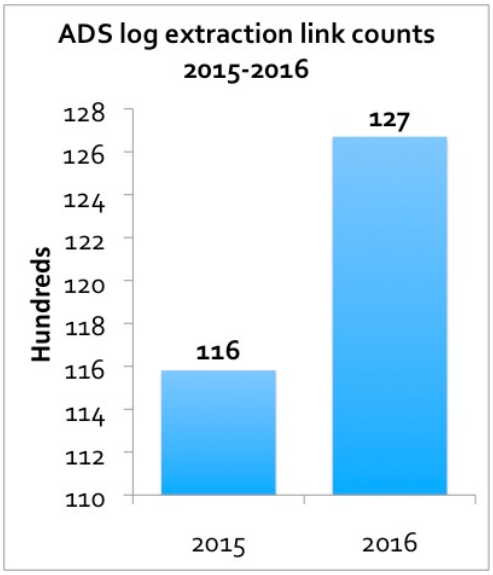



Figure 1: Views of ASCL entries in ADS

Citations to the ASCL have also increased, nearly doubling again; this has been the trend since citations to ASCL first started being tracked by ADS in 2012. Citations are discussed more fully in the section "Impact on the community."

According to Google Analytics, views of the site in 2016 decreased by 3% over 2016; the site was viewed 109K times in 2015 and 107K times in 2016; this follows a drop of 7% in views from 2014 to 2015. We did not understand the decrease in pageviews last year, as by other measures, use of the site had increased (as it did again in 2016). Since then, we have seen that the decrease is accounted for by the diminishing efficacy of links from the popular APOD site in driving traffic to the ASCL; viewers not involved in astrophysics research have now mostly seen the link and no longer click on it out of curiosity. However, APOD is still an important marketing tool and continues to bring awareness of the ASCL to astronomers.

## New capabilities and features

Through an agreement with University of Maryland Libraries, the ASCL has been granted an account for minting DOIs for the relatively few research codes it holds; DOIs have been created for all ASCL-housed codes.

A public dashboard showing different statistics such as the number of codes in the ASCL, the number of citations to ASCL entries, and code additions by year, was moved into production in March 2016. The scripts that create the dashboard are run twice a week. One key feature of this dashboard is a report on the number and percentage of site links working, which is included to let users know that we do check links regularly. A dashboard for administrators was added in August; in addition to the information shown on the public dashboard, it shows the number of codes awaiting ASCL IDs, the five codes with the most citations, the number of codes submitted by authors, and which links are reported broken and the error code returned.

Dr. Federica Bianco, who has a code in the ASCL, suggested we provide shields for authors to add to their download pages, as some other sites do, so we have added this service. The shield and the HTML to create it are available in the ASCL entry, and when placed on a code's download site, serve as a link to the ASCL entry.

An ASCL shield

We have added a *Preferred citation method* field to entries, and one of the activities in the Birds of a Feather session we held at the Astronomical Data Analysis Software and Systems (ADASS) meeting in October was gathering information to populate that field. As of November 2016, 130 entries included preferred citation information. We expect to see greater use of this field over time.

The CodeMeta project advocates use of a JSON-LD file (codemeta.json) on a code's download site for storing metadata about the software. The ASCL has added a form that enables pulling information in a codemeta.json file into a new code submissions form to reduce the effort it takes to submit software to the ASCL.

## Support and funding

Heidelberg Institute for Theoretical Studies (HITS) through Dr. Kai Polsterer provided €6,000 in funding at the end of 2015 for work in 2016; this support enabled the ASCL's presence at various conferences and participation in meetings on research software, such as Force 2016, and in a one-day meeting with ADS staff in Boston to improve the flow of information between ADS and the ASCL. The ASCL is deeply grateful for this support.

The editor was invited to participate in a software metadata project meeting (CodeMeta; http://codemeta.github.io/) in April in Portland, Oregon and is very thankful for the support received from the organizers to attend.

In September, the editor's participation in the Fourth Workshop on Sustainable Software for Science: Practice and Experiences (WSSSPE4) meeting in Manchester (U.K.) was supported by the organization sponsoring the event. The ASCL and its editor are very grateful for the support received that made it possible to attend.

Michigan Technological University (Houghton, MI) hosts the ASCL website and provides technical support, and the University of Maryland (College Park, MD) provides office space and other university services including library access; the ASCL assigns DOIs through an arrangement with the University of Maryland Libraries. The ASCL is very grateful for this valuable ongoing support.

The proposal mentioned in last year's annual report, an American Astronomical Society-headed project to improve software indexing and citation, was not completed by the end of 2015. The final design of the project did not offer support for improvements to the ASCL, resulting in the withdrawal of the ASCL from the proposal eventually submitted to the Sloan Foundation in 2016. At OpenCon 2016, a potential new collaboration with ContentMine and its founder Peter Murray-Rust was discussed, and a letter of interest for funding was sent to the Laura and John Arnold Foundation in December.

## Impact on the community

The ASCL uses various measures to try to determine its impact on and use by the community. Aside from wanting codes to be cited in a trackable way, the ASCL has no concern on how codes are cited. That said, we use citation numbers as a metric to learn how and whether the ASCL is being used. Citations continue to increase at a faster rate than growth in the number of code entries. By the end of 2016, 332 ASCL entries collectively had 1102 citations, meaning 23.7% of the 1401 codes indexed in ADS at that time had citations, up from 17.5% in January of 2016.

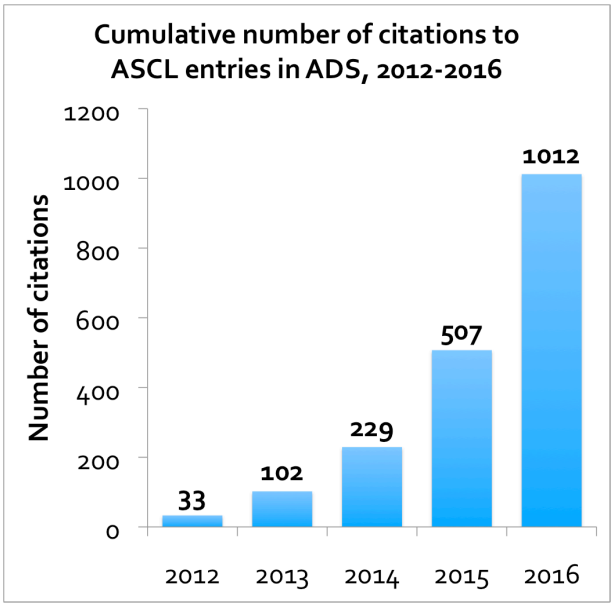



Figure 2: Cumulative citations to ASCL entries by year

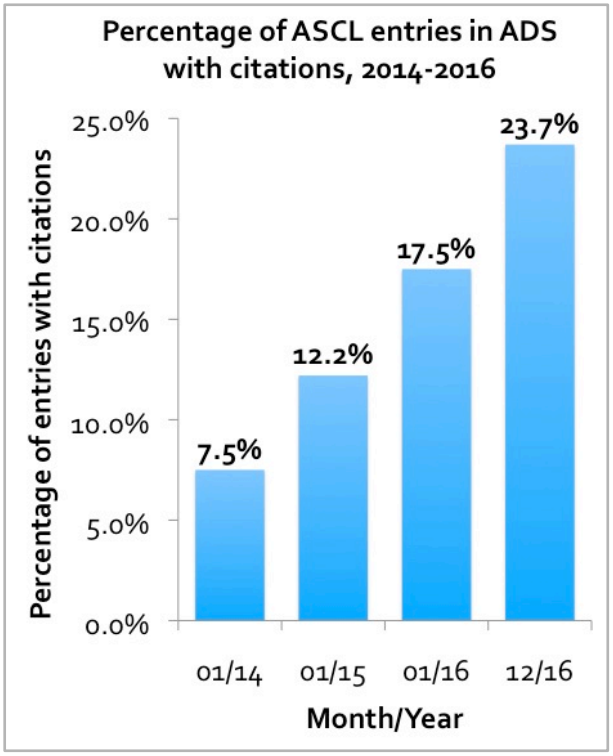



Figure 3: Percentage of ASCL entries in ADS with citations

Authors continue to submit their software to the ASCL; 57 author submissions were accepted into the ASCL in 2016, fully 25% of the codes added. We take this as an indication that software authors see value in registering their codes with the ASCL.

As of May 2016, ASCL records are indexed by the Web of Science's Data Citation Index, and in July 2016 after a conversation with Megan Force from Web of Science, it was determined ASCL records would be indexed quarterly.

## People

The Advisory Committee members in 2016 were:

Peter Teuben, University of Maryland, *Chair*
Bruce Berriman, Infrared Processing and Analysis Center/Caltech
Jessica Mink, Center for Astrophysics
Robert Nemiroff, Michigan Technological University
Thomas Robitaille, Freelance software developer
Lior Shamir, Lawrence Technological University
Keith Shortridge, Australian Astronomical Observatory
Mark Taylor, University of Bristol, UK
John Wallin, Middle Tennessee State University

Dr. Robitaille served on the committee for 2016, and Dr. Rein Warmels of ESO agreed to rotate into the one-year seat for 2017. Alice Allen and Kimberly DuPrie (Space Telescope Science Institute) are Editor and Associate Editor, respectively. Judy Schmidt provides development and design work for the ASCL, and P.W. Ryan provides development work and support for citation and other statistics tracking.

## 2016 Highlights

| | |
|---|---|
| January | Collaborated with the Moore-Sloan Data Science Environment at NYU on a Special Session called *Tools and Tips for Better Software* at the 227th AAS meeting (Kissemmee, FL)<br>Presented the ASCL in two posters<br>http://ascl.net/wordpress/?p=1612<br>http://ascl.net/wordpress/?p=1608<br>*Nature* Toolbox Q&A with ASCL editor published online on January 22<br>http://www.nature.com/news/the-code-librarian-1.19220 |
| February | *Nature* Toolbox Q&A with ASCL editor published in print in February 4 issue |
| March | Dashboard released |
| April | Editor presented at National Library of Medicine (April 12)<br>Editor participated in The Future of Software Metadata in Portland, Oregon, April 15 - 17 2016 and in Force2016 conference; member of the Software Citation Working Group<br>Library of Congress blog post about ASCL appears on April 28<br>*Preferred citation method* field moved to production |
| May | Associate Editor Kimberly DuPrie presented ASCL at a "Coffee Science" talk at Space Telescope Science Institute<br>Editor invited to participate in Dagstuhl Perspectives Workshop,"Engineering Academic Software" in June<br>ASCL entries included in the live Data Citation Index, Web of Science<br>Codes deposited by their authors in the ASCL are assigned DOIs<br>Peter Teuben, developer P.W. Ryan, and Alice Allen participated in a Hack Day with ADS on May 23 |

| | |
|---|---|
| June | Added key word "software" to ADS report for all entries<br>Editor participated in Dagstuhl Perspectives Workshop "Engineering Academic Software", June 19-24; outcomes from this will include a published manifesto and other works. See ASCL blog posts for more information. |
| August | Administrator dashboard developed and implemented<br>Editor proposal to attend OpenCon2016 in Washington, DC accepted |
| September | Submitted proposal for Special Session at the European Week of Astronomy and Space Science (EWASS) 2017 (with Rein Warmels as co-organizer)<br>Editor attended the Fourth Workshop on Sustainable Software for Science: Practice and Experiences (WSSSPE4) and served on panel organized by Simon Hettrick (SSI) |
| October | Poster presentation on the ASCL (blog post) given and a Birds of a Feather (BoF) session on software citation held at ADASS in Trieste (blog post 1, blog post 2, slides, Google doc) |
| November | Editor attended OpenCon2016 in Washington DC and while there, led a brief unconference discussion on software citation and gave a two-minute project presentation on the ASCL<br>The Dagstuhl report *Engineering Academic Software* released http://dx.doi.org/10.4230/DagRep.6.6.62<br>Two ADASS proceedings papers were uploaded to arXiv: *Astrophysics Source Code Library: Here we grow again!*: https://arxiv.org/abs/1611.06219 and *Implementing Ideas for Improving Software Citation and Credit*: https://arxiv.org/abs/1611.06232<br>Submission via codemeta.json URL moved to production<br>Shields on code entries moved to production<br>ASCL published a list of software events at upcoming AAS meeting |
| December | Blog post and AAS post on software events at #AAS229 published<br>Partnering with ContentMine.org/Peter Murray-Rust, a Letter of Interest was submitted to the Laura and John Arnold Foundation for funding |

## 2016 Plans Revisited

- Publish dashboard
  - Dashboard released in March
- Create ASCL index in 2015 ADASS proceedings
  - Completed
- Organize a session for AAS 229th meeting on software issues
  - Completed
- Present ASCL at at least two conferences
  - Completed; the ASCL was presented at AAS and ADASS and had a presence at Force 2016, Engineering Research Software, WSSSPE4, and OpenCon2016
- Work with publishers to improve software citation in journals
  - Journal contacts for the year included AAS journals, *Astronomy & Computing*, and *Science*
- Sustain reasonable growth in number of entries (190-210 additions)
  - 227 codes were added in 2016
- Upgrade current site to add two new features
  - Public and administrator dashboards put into production
  - *Preferred citation method* field moved to production

    - Shields on code entries moved to production
    - Submission by codemeta.json added to Submissions page
- Complete outstanding plans from previous years
    - Still outstanding: add another two members to the Advisory Committee

## 2017 Plans

- Create ASCL index in 2016 ADASS proceedings
- Present ASCL at at least two conferences
- Sustain reasonable growth in number of entries (190-210 additions)
- Implement a mirror site
- Create real-time data backup for submissions and newly-published entries
- Complete outstanding plans from previous years
    - Add two members to the Advisory Committee

## Press and bibliography

The Astrophysics Source Code Library
Library of Congress *The Signal*, April 28, 2016

The code librarian
*Nature* Toolbox, January 22, 2016 (online)
February 4 print issue

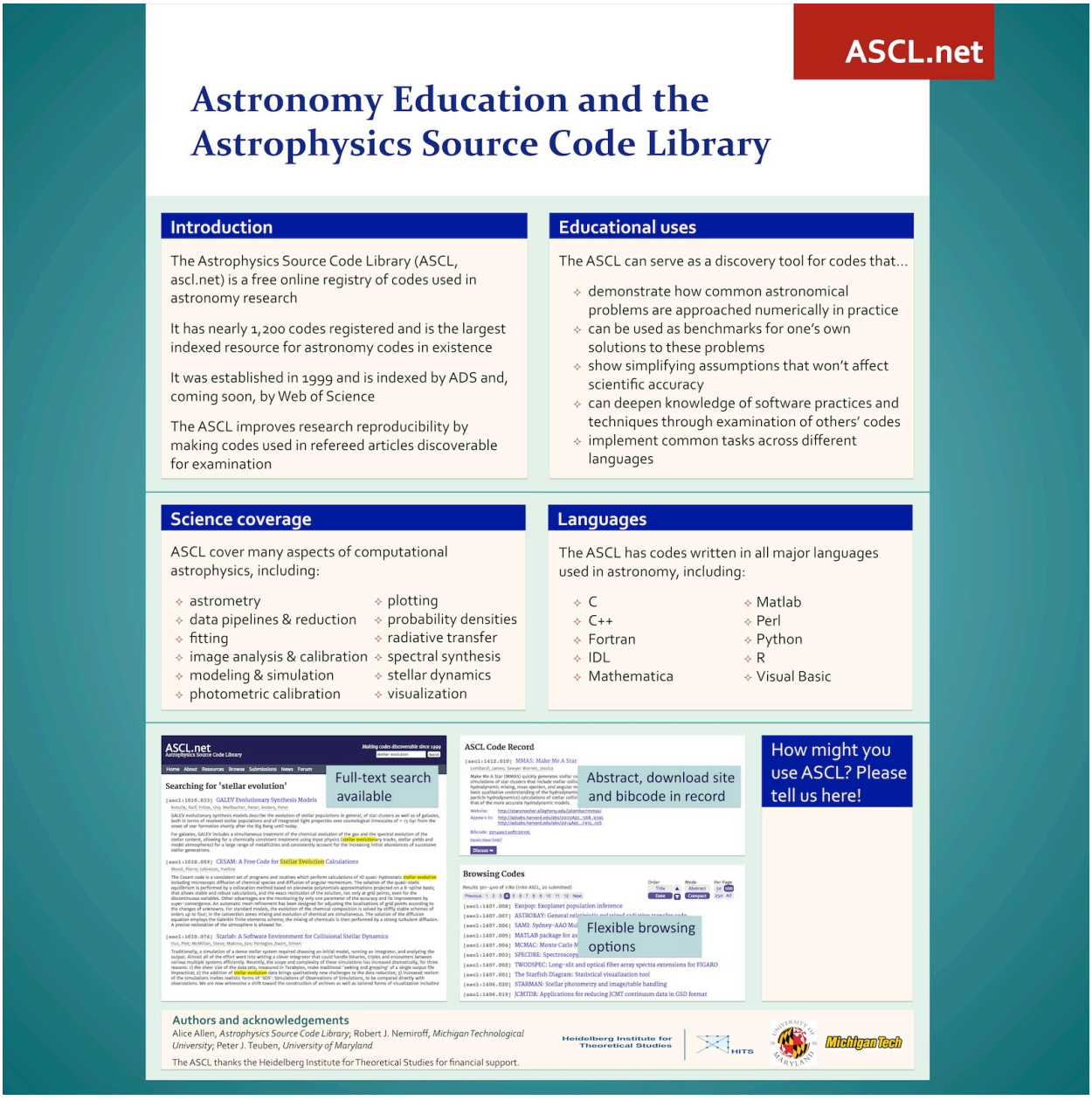
Implementing Ideas for Improving Software Citation and Credit
Peter Teuben *et al*, Astronomical Data Analysis Software and Systems XXVI, October 2016
Pre-print | Blog post | Resources | Session Google doc

Astrophysics Source Code Library: Here we grow again!
Alice Allen *et al*, Astronomical Data Analysis Software and Systems XXVI, October 2016
Pre-print | Poster

Making your code citable with the Astrophysics Source Code Library
Alice Allen *et al*, American Astronomical Society, AAS Meeting #227, January 2016, #227, id.348.01
Poster

Astronomy education and the Astrophysics Source Code Library
Alice Allen, Robert J. Nemiroff, American Astronomical Society, AAS Meeting #227, January 2016, #227, id.247.07
Poster

# AAS Posters, January 2016



ASCL.net

## Astronomy Education and the Astrophysics Source Code Library

### Introduction

The Astrophysics Source Code Library (ASCL, ascl.net) is a free online registry of codes used in astronomy research

It has nearly 1,200 codes registered and is the largest indexed resource for astronomy codes in existence

It was established in 1999 and is indexed by ADS and, coming soon, by Web of Science

The ASCL improves research reproducibility by making codes used in refereed articles discoverable for examination

### Educational uses

The ASCL can serve as a discovery tool for codes that…

- demonstrate how common astronomical problems are approached numerically in practice
- can be used as benchmarks for one's own solutions to these problems
- show simplifying assumptions that won't affect scientific accuracy
- can deepen knowledge of software practices and techniques through examination of others' codes
- implement common tasks across different languages

### Science coverage

ASCL cover many aspects of computational astrophysics, including:

- astrometry
- data pipelines & reduction
- fitting
- image analysis & calibration
- modeling & simulation
- photometric calibration
- plotting
- probability densities
- radiative transfer
- spectral synthesis
- stellar dynamics
- visualization

### Languages

The ASCL has codes written in all major languages used in astronomy, including:

- C
- C++
- Fortran
- IDL
- Mathematica
- Matlab
- Perl
- Python
- R
- Visual Basic



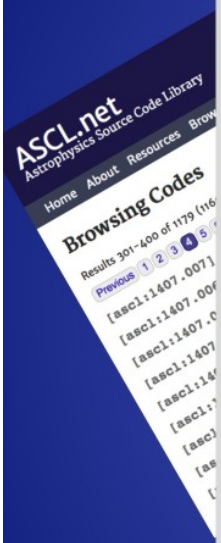
**Authors and acknowledgements**

Alice Allen, *Astrophysics Source Code Library*; Robert J. Nemiroff, *Michigan Technological University*; Peter J. Teuben, *University of Maryland*

The ASCL thanks the Heidelberg Institute for Theoretical Studies for financial support.

ASCL.net

# Making your code citable with the Astrophysics Source Code Library




## Introduction

The Astrophysics Source Code Library (ASCL, ascl.net) is a free online registry of codes used in astronomy research

With nearly 1,200 codes, it is the largest indexed resource for astronomy codes in existence

Established in 1999, it offers software authors a path to citation of their research codes even without publication of a paper describing the software

It increases the transparency of research by providing scientists a way to find codes used in refereed articles

An ASCL entry for a code with a DOI can make citations using the DOI trackable in ADS

## Features

All major astronomy journals accept citations using ASCL IDs

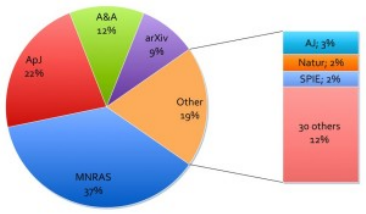
ASCL is indexed by ADS and, coming soon, by Web of Science

Features include

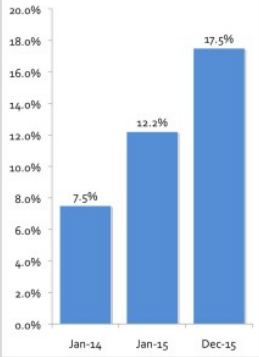
- easy submissions form
- flexible browsing options
- search capabilities
- RSS feeder for updates

A changes/additions form lets authors submit links for papers using their codes for addition to the ASCL entry, thus linking codes with research using them

## Citations to ASCL entries by journal 12/6/15




## Percentage of entries in ADS with citations




## Tracking DOI citations

Code author places code in DOI-minting resource

↓

Code cited using DOI

↓

ASCL entry created through code author submission or ASCL editor discovery

↓

ASCL associates DOI with ASCL entry

↓

ADS ingests ASCL entry with corresponding DOI

↓

ADS re-resolves reference

↓

ADS finds DOI in system, counts citation

## Issues with software citation

Codes are often not cited; those that are may be cited in a way that isn't trackable, such as repository URL, DOI, software name with other details, or user manual

**AUTHORS AND ACKNOWLEDGEMENTS**

Alice Allen, Kimberly DuPrie, Judy Schmidt, G. B. Berriman, Jessica D. Mink, Robert J. Nemiroff, Thomas Robataille, Lior Shamir, Keith Shortridge, Mark B. Taylor, Peter J. Teuben, John F. Wallin

We thank Wes Rian & ADS for publication stats, Alberto Accomazzi for the DOI citation workflow, & the Heidelberg Institute for Theoretical Studies for financial support.

Heidelberg Institute for Theoretical Studies | HITS | Michigan Tech

## ADASS Poster, October 2016

# ASCL.net

## ASTROPHYSICS SOURCE CODE LIBRARY
## HERE WE GROW AGAIN

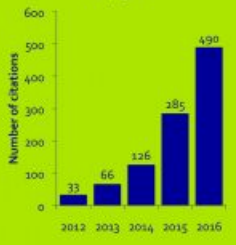
*Free online citable registry of astrophysics source codes*

Over 1300 codes registered
Code entries cited in nearly 50 journals, including A&A, MNRAS, ApJ, A&C, PASP, *Nature* and *Science*
Indexed by Web of Science (WoS) and Astrophysics Data System (ADS)

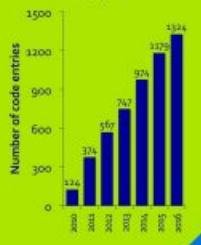
### GROWTH

Citations to ASCL entries have doubled each year since 2012.

Citations by year (from ADS) 2012 - 2016 as of Sep 15, 2016

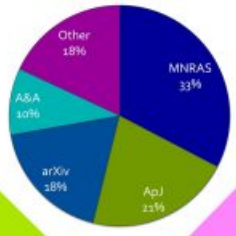



Cumulative number of code entries 2010 – 2016 as of Sep 15, 2016




On average, we add 19 codes per month.
Since 2014, 160 codes accepted were submitted by their authors.

Citations by journal (from ADS) as of Sept. 18, 2016




### NEW IN 2016

DOIs for codes deposited in the ASCL
Ability to list preferred citation method in code record
Indexing by Thomson-Reuters Web of Science
Registered with re3data.org
Dashboard showing
- code addition and record citation statistics
- top ten prolific authors and most-viewed codes

*Did you see our Q&A in Nature Toolbox? (Feb 4 issue!)*

### INFLUENCE

As a prominent domain library for research codes, ASCL is often asked to provide input on scientific software issues.

2016 events include:

National Library of Medicine
Rockville MD, USA

CodeMeta and Force2016
Portland OR, USA

Engineering Scientific Software
Dagstuhl, Germany

Working towards Sustainable Software for Science 4
Manchester, UK

### SPONSORS

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Alice Allen (ASCL), Bruce Berriman (IPAC, Caltech), Kimberly DuPrie (STScI/ASCL), Jessica D. Mink (SAO), Robert J. Nemiroff (MTU), Thomas Robitaille (Freelance), Judy Schmidt (ASCL), Lior Shamir (LTU), Keith Shortridge (AAO), Mark B. Taylor (UBristol), Peter J. Teuben (UMD), John F. Wallin (MTSU)