



AMERICAN ASTRONOMICAL SOCIETY



## Software papers and citation in the AAS Journals

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# emcee

The screenshot shows a web browser window with several tabs open, including 'AAS - American...', '[1202.3665] em...', 'Home - BBC News', 'nph-article\_page', 'SAO/NASA ADS', 'Interferomet...', and 'nph-article\_page'. The address bar shows 'Secure https://arxiv.org/abs/1202.3665'. The page header includes the Cornell University Library logo and a notice: 'We gratefully acknowledge support from the Simons Foundation and member institutions'. The breadcrumb trail is 'arXiv.org > astro-ph > arXiv:1202.3665'. A search bar contains 'Search or Article ID' and 'All papers'. The main content area is titled 'Astrophysics > Instrumentation and Methods for Astrophysics' and features the paper 'emcee: The MCMC Hammer' by Daniel Foreman-Mackey, David W. Hogg, Dustin Lang, and Jonathan Goodman. The submission date is 'Submitted on 16 Feb 2012 (v1), last revised 25 Nov 2013 (this version, v4)'. The abstract describes a Python implementation of the affine-invariant ensemble sampler for Markov chain Monte Carlo (MCMC). The right sidebar contains a 'Download' section with links for PDF, PostScript, and other formats. Below that is the 'Current browse context' section, showing 'astro-ph.IM' and navigation links. The 'Change to browse by' section lists categories like 'astro-ph', 'physics', 'physics.comp-ph', 'stat', and 'stat.CO'. The 'References & Citations' section lists 'NASA ADS'. The '4 blog links' section shows a link to 'stat.1311.0001'. The 'Bookmark' section includes icons for various services. The 'Submission history' section lists four versions of the paper with their dates and sizes. At the bottom, there is a link to 'Which authors of this paper are endorsers?' and a note to 'Disable MathJax (What is MathJax?)'.

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arXiv.org > astro-ph > arXiv:1202.3665

Search or Article ID All papers

(Help | Advanced search)

Astrophysics > Instrumentation and Methods for Astrophysics

## emcee: The MCMC Hammer

Daniel Foreman-Mackey, David W. Hogg, Dustin Lang, Jonathan Goodman

(Submitted on 16 Feb 2012 (v1), last revised 25 Nov 2013 (this version, v4))

We introduce a stable, well tested Python implementation of the affine-invariant ensemble sampler for Markov chain Monte Carlo (MCMC) proposed by Goodman & Weare (2010). The code is open source and has already been used in several published projects in the astrophysics literature. The algorithm behind emcee has several advantages over traditional MCMC sampling methods and it has excellent performance as measured by the autocorrelation time (or function calls per independent sample). One major advantage of the algorithm is that it requires hand-tuning of only 1 or 2 parameters compared to  $\sim N^2$  for a traditional algorithm in an  $N$ -dimensional parameter space. In this document, we describe the algorithm and the details of our implementation and API. Exploiting the parallelism of the ensemble method, emcee permits any user to take advantage of multiple CPU cores without extra effort. The code is available online at [this http URL](#) under the MIT License.

Comments: Code re-licensed under MIT

Subjects: Instrumentation and Methods for Astrophysics (astro-ph.IM); Computational Physics (physics.comp-ph); Computation (stat.CO)

DOI: [10.1086/670067](#)

Cite as: arXiv:1202.3665 [astro-ph.IM] (or arXiv:1202.3665v4 [astro-ph.IM] for this version)

### Submission history

From: Daniel Foreman-Mackey [[view email](#)]

[v1] Thu, 16 Feb 2012 20:41:19 GMT (17kb)

[v2] Sat, 18 Feb 2012 03:52:41 GMT (18kb)

[v3] Wed, 30 Jan 2013 15:48:37 GMT (15kb)

[v4] Mon, 25 Nov 2013 15:56:48 GMT (15kb)

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physics.comp-ph

stat

stat.CO

### References & Citations

- NASA ADS

4 blog links ([what is this?](#))

Bookmark ([what is this?](#))

## Policy Concerning Papers on Computation

THE increasing availability of automatic calculating machines has naturally led to increased activity in programming astronomical calculations for such machines. The formulation of a problem in suitable terms for efficient automatic solution, as well as the actual programming, are tasks that are often far from trivial, and sometimes they require much ingenuity and perseverance. The result may be an important contribution to astronomy. The question forced upon us is: what place, if any, do computational papers deserve in this *Journal*? We assume, of course, that the work is too specialized to be suitable for any of the several journals devoted to the art of computation.

Papers on computation may be divided into the following types, in order of decreasing generality:

1. Methods, such as Bessel's method for the reduction of stars from mean to apparent place, or the method of dependences for the reduction of photographic observations of asteroids and comets. These examples are mentioned merely to indicate the character of the contribution, not the subject matter. Such papers clearly belong in the research literature, and are appropriate for this *Journal*.

2. Collections of formulae, designed to facilitate the practical application of a method. These, we think, are usually more appropriate for textbooks or monographs than for the *Journal*, although there are some exceptions. An important one is the case where material of type 2 is an essential part of a paper of type 1.

3a. Precepts for programming a method for automatic calculating machines, including such things as formulae for the numerical evaluation of functions, convergence of series expansions, algorithms, and computational precision.

3b. Programs written in a so-called universal language, such as Algol or Fortran.

3c. Programs written in machine language.

We think that papers of type 3 are of doubtful propriety for this *Journal*. They are not astronomical, although they may be important tools for astronomers. To a considerable extent, the need for communication between astronomers mutually interested in computational problems is already supplied by the associations of users of automatic calculating machines.

Until further notice, papers of type 3 will not be printed, and papers of type 2, like all other contributions, will be strictly judged according to their content of original research.

The Editors

# Policy on Software in Journals

If a piece of novel software is important to published research then it is likely appropriate to describe it in such a paper.



# Policy on Software in Journals

Papers can be  
**short,**  
**descriptive,**  
and need **not** include  
research results.

# A note on open source

We recommend authors release code under an open source license, but do not require it.

(Do open source codes get more citations?!?)

# What about citation?

Cite the Software Paper

**AND**

Cite the Code

**AND**

Use `\software{}`



# \software}

*Software:* `trappist1arctic_2016` (Morris 2017), `astropy` (Astropy Collaboration et al. 2013), `photutils` (Bradley et al. 2016), `george` (Foreman-Mackey 2015), `emcee` (Foreman-Mackey et al. 2013), `astroplan` (Morris et al. 2017)

*Facility:* APO/ARC 3.5m

# Enforcing citation of software



# ‘Living’ Papers

The screenshot shows a web browser window displaying the arXiv page for the paper 'The Astropy Project: Building an inclusive, open-science project and status of the v2.0 software'. The browser's address bar shows the URL 'https://arxiv.org/abs/1801.02634'. The page header includes the Cornell University Library logo and a search bar. The main content area features the paper title, a list of authors, a submission date, and a summary paragraph. A right-hand sidebar contains navigation options like 'Download', 'Current browse context', 'Change to browse by', 'References & Citations', and 'Bookmark'. The bottom of the page includes a 'Submission history' section.

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We gratefully acknowledge support from the SIMONS FOUNDATION and member institutions

arXiv.org > astro-ph > arXiv:1801.02634

Search or Article ID  All papers

help | advanced search

Astrophysics > Instrumentation and Methods for Astrophysics

## The Astropy Project: Building an inclusive, open-science project and status of the v2.0 software

A. M. Price-Whelan, R. M. Sipőcz, H. M. Günther, P. L. Lim, S. M. Crawford, S. Conroy, D. L. Shupe, M. W. Craig, N. Dercheva, A. Ginsburg, J. T. VanderPlas, L. D. Bradley, D. Pérez-Suárez, M. de Val-Borro, T. L. Aldcroft, K. L. Cruz, T. P. Robitaille, E. J. Tollerud, C. Ardelean, T. Babej, M. Bachetti, A. V. Bakanov, S. P. Bamford, G. Barentsen, P. Barmby, A. Baumbach, K. L. Berry, F. Biscani, M. Boquien, K. A. Brostrom, L. G. Bourra, C. B. Brammer, E. M. Bray, H. Breytenbach, H. Dudzielmeijer, D. J. Burke, G. Calderone, J. L. Cazo Rodríguez, M. Cara, J. V. M. Cardoso, S. Cheedella, Y. Copin, D. Crichton, D. Dávella, C. Deil, É. Depagne, J. P. Dietrich, A. Donath, M. Droettboom, N. Earl, T. Erzen, S. Fabbró, L. A. Ferreira, T. Finethy, R. T. Fox, L. H. Garrison, et al. (80 additional authors not shown)

(Submitted on 8 Jan 2018)

The Astropy project supports and fosters the development of open-source and openly-developed Python packages that provide commonly-needed functionality to the astronomical community. A key element of the Astropy project is the core package *Astropy*, which serves as the foundation for more specialized projects and packages. In this article we provide an overview of the organization of the Astropy project and summarize key features in the core package as of the recent major release, version 2.0. We then describe the project infrastructure designed to facilitate and support development for a broader ecosystem of inter-operable packages. We conclude with a future outlook of planned new features and directions for the broader Astropy project.

Comments: Submitted to MNRAS journals. Comments and feedback welcome through the paper source repository: [this GitHub repository](#). For more information about Astropy, see [this GitHub page](#).

Subjects: Instrumentation and Methods for Astrophysics (astro-ph.IM)

Cite as: [arXiv:1801.02634](#) [astro-ph.IM] (or [arXiv:1801.02634v1](#) [astro-ph.IM] for this version)

Submission history

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new | recent | 1801

Change to browse by: astro-ph

References & Citations

- NASA ADS

Bookmark what is this?

# ‘Living’ Papers

‘Living’ Papers can be **updated**, with new sections **added** and author lists **expanded**.

**Papers published since 2009 can be updated.**

**Contact me if you want your paper to live!**

## Work Still to Do

Are DOIs for software useful?

How do we encourage good software practice?

Should we review software itself?