Astropy Community Engagement

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Astropy Community Engagement Report

This report was created in early 2024 by the team at Organizational Mycology for the Astropy Open Source community.

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Abstract: This report presents an analysis of data collected from an Astropy community engagement survey, with the aim of understanding the community's composition, participation avenues, communication channels, and strategies to increase involvement. The majority of survey respondents are professional astronomers, primarily from North America, and in early to mid-career stages, with 40% having been involved with Astropy for 5-10 years. Astropy is recognized for its high-quality, well-documented open-source software, and its community is appreciated for being friendly and supportive, with transparent and organized leadership. The main modes of engagement include GitHub, documentation, educational materials, and the practical application of Astropy software. Communication within the community is primarily conducted through online forums, which serve as platforms for technical support and updates. However, fragmentation between users and developers and a lack of awareness about certain forums like Slack and Facebook have been identified as areas for improvement. To enhance participation, respondents suggest simplifying the contribution process, improving documentation standards, and offering more support for educational resources. Barriers to contribution include the intimidating nature of Git, the complexity of the software, and the perceived value of contributions to one's career. The report concludes with recommendations for increasing community participation, such as developing resources for beginners, improving communication, and conducting outreach. Additionally, consultant recommendations focus on helping newcomers integrate, visualizing the user-to-contributor pipeline, making resources more visible, and cultivating a positive community culture.

Executive Summary

This paper synthesizes data we collected in an Astropy community engagement survey. We focus on four research questions to better understand:

1. the composition of the Astropy community,
2. avenues for participation among Astropy members,
3. suggestions for streamlining communication channels in the community and
4. ways to increase participation

Community Composition

The majority of people who responded to the survey are professional astronomers with a concentration of respondents in North America. The population skews towards early to mid career astronomers. Forty percent of the respondents have been involved with Astropy for between 5-10 years.

Participation in Astropy

- Respondents speak about Astropy as a high quality, well documented open software product that they find useful in their work.
- Respondents liked that the community was friendly, welcoming and that there was a culture of constructive feedback and support. They describe the leadership as transparent and well organized.
- Respondents engage with Astropy primarily via GitHub, documentation, educational materials and through using Astropy software in their work.

Communication Channels

- Astropy's community describe the online forums as the place where they get answers to questions and stay up to date with technical updates on Astropy.
- They describe the online forums such as Slack and Facebook as an alternative to GitHub issues and they commented on the benefit of seeing the technical development as well as finding new use cases for the software.

- When asked what would improve the forums, respondents discussed the fragmentation in the Astropy forums between users and developers.
- Discourse was generally seen as less active, while opinions on Slack, Facebook, Bluesy and Twitter varied.
- Notably, we see a number of respondents who did not know that Slack or Facebook forums exist in the Astropy community.
- Respondents asked for searchable community forums, and clear directions new community members.

Improving Participation

- When asked what people would change about Astropy, respondents said they wanted to make contributions to the community easier, specifically development of new tools.
- Some suggested improved standards for documentation and more support for non-Astropy software.
- We saw comments about code quality and maintenance, support for educational resources and early career astronomers.

- When asked what were the barriers to contributing to the community, respondents discussed feeling intimidated by Git, the complexity of the software and the amount of technical skill that's needed to contribute as well as simply knowing where to start to make a contribution.

- Some also talked about the challenge of being able to consider contributions to Astropy as being a valuable part of their career. Some brought up the ability to learn how to engage with the Astropy community as well as seeing documentation as a barrier.

We conclude the paper with community and consultant recommendations.

Community Recommendations

- Improve community participation
- Work on beginner resources
- Create a contribution list
- More communication with the community to learn about platforms
- Create workshops
- More Outreach
- Additional ideas

Consultant Recommendations

- Help Newcomers acclimate by
  - Being welcoming
  - Evaluate project-person fit
  - Make it easy to find communication channels
  - Identify good first contributions.
- Develop and Visualize User-to-contributor pipelines
- Make existing resources visible
- Improve the culture

Part I.

Introduction and Methods

1. Introduction

Community engagement is essential for growing and sustaining healthy open source software projects. Astropy recently hired a community manager, Beryl Kanali, to improve the project's community-building strategies and contracted with Organizational Mycology to help Beryl get started by conducting introspective research and developing survey instruments for monitoring community engagement. This report summarizes one component of that work, a community survey that interrogated how Astropy users, contributors, and developers interact with the project, their motivations for doing so, and the benefits and drawbacks of participation. The results of this survey can help to inform community management work at Astropy to foster healthy, sustained engagement as well as shape Astropy's broader community strategy.

1.1. Research Questions

Our engagement with Astropy had four work streams:

1. Supporting Beryl Kanali in her new role as the community manager of Astropy.
2. Tracking the engagement of the community across various platforms,
3. Conducting a community engagement survey of the community and
4. Conducting a small number of interviews with community members who were willing to talk about how they experience DEI (Diversity, Equity and Inclusion) within the Astropy community.

The research questions for our work are:

- What is the composition of Astropy community members?
- How do community members participate in Astropy?
- How can we streamline communication channels?
  - What are people using different communication channels for?
- What avenues can we explore to increase/improve participation in the community?
- Can we identify ways to improve diversity, equity and inclusion in the Astropy community?

This report will summarize answers to the first four research questions. The final research question will be summarized in a document that addresses the diversity, equity and inclusion needs of the community as it will include both answers from the community engagement survey and information from the interviews we conducted with community members on the topic.

2. Methods

As noted above, we began by developing the research questions that the leadership team and community manager posed to better understand the Astropy community. In addition to work on tracking enegement and DEI, we constructed a survey that would address the research questions, going through several iterations of refining the survey questions as a team. We put the survey into Typeform (an online survey platform) and pretested the questions with two members of the Astropy community. These pretesters were asked them to take the survey with a member of the research team watching their screen. We asked them to "talk out loud" while filling out the survey, sharing any confusion, challenges or questions they had. Pretesting is a well known method of ensuring that the survey works for the community and it helps the research team troubleshoot problems with wording or question order before the survey goes to the wider community. From these pretests, we gained insights that changed the wording and order of a few survey questions as well as the suggestion of at least one additional question.

To recruit survey responses, we sent an email to the google group `astropy-dev`, the Astropy slack, the Facebook group (Python users in Astronomy) and engaged on X / Twitter as well. We did several follow up emails to give folks several opportunities to answer the survey, giving over a week and a half to respond. We ended with a total of n=98 of respondents to the survey with one duplicate.

Data quality is slightly impacted because the first 7 respondents had an erroneous logic loop in the survey software that made it impossible to continue unless answering one question in a particular way. We will note where this impacts the results, but we do not believe it impacts the findings significantly.

2.1. A Note About Qualitative Research

We qualitatively analyzed the open survey responses by annotating each one with codes (think of qualitative coding as tagging or annotating the data). We then grouped together like responses and found themes in the data. A few things to note about this type of analysis.

In this report we will share the themes that emerged in the data with a short description and a number of quotes that show examples of the theme. For the Astropy community, we elected to offer more quotes than we might in a non-academic white paper because we believed the raw data of the survey responses would be of interest to this community.

We omitted redundant or repetitive responses, but in qualitative research we do not omit data if it contradicts other data. This means that if there is variation in a theme - meaning that people in the community disagreed - we include both perspectives and note the contradiction.

Following the conventions of qualitative research, we do not edit what was written by respondent when we quote them, even if that means that there are typos, mistakes or misspellings in the responses. This done is to preserve the voice of the respondent.

Part II.

Survey Results

3. Community Composition

Our first research question was look at the composition of the Astropy Community. In the survey, we asked questions to get a better sense of the role, age, involvement level, geographic location and how comfortable respondents felt giving feedback to Astropy leadership.

Generally we find that the majority of respondents are professional astronomers in early to mid career. We see a long term commitment among respondents to Astropy with 40% being involved with Astropy between 5-10 years. Respondents were primarily in North America.

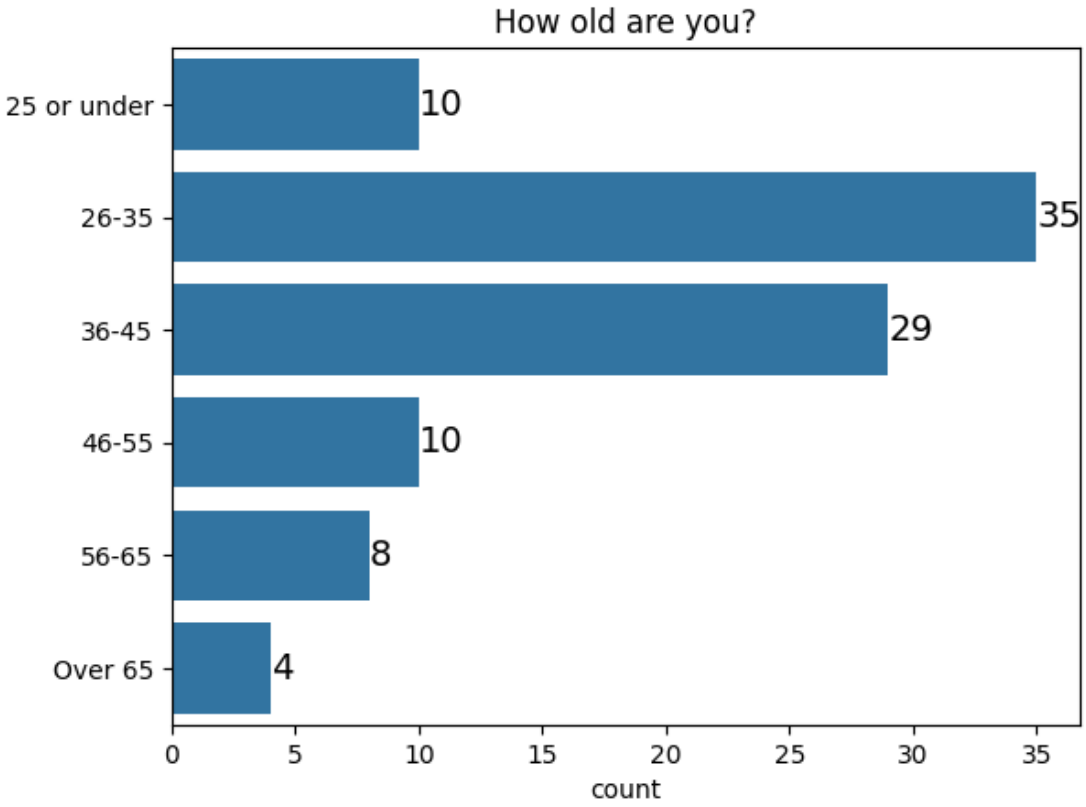
3.1. Professional Astronomers

The survey team was interested to know what percentage of respondents work professionally in the field of astronomy. Not surprisingly, an overwhelming majority of respondents, 93% (n=89) make a living in a field that is related to astronomy.

Those who do not work in Astronomy are a student, a freelance software developer, a retiree, an academic, a space industry professional, a healthcare professional and a planetary defence worker. Many of these are astronomy / science adjacent, even if not identified by the respondent as an "astronomy" jobs.

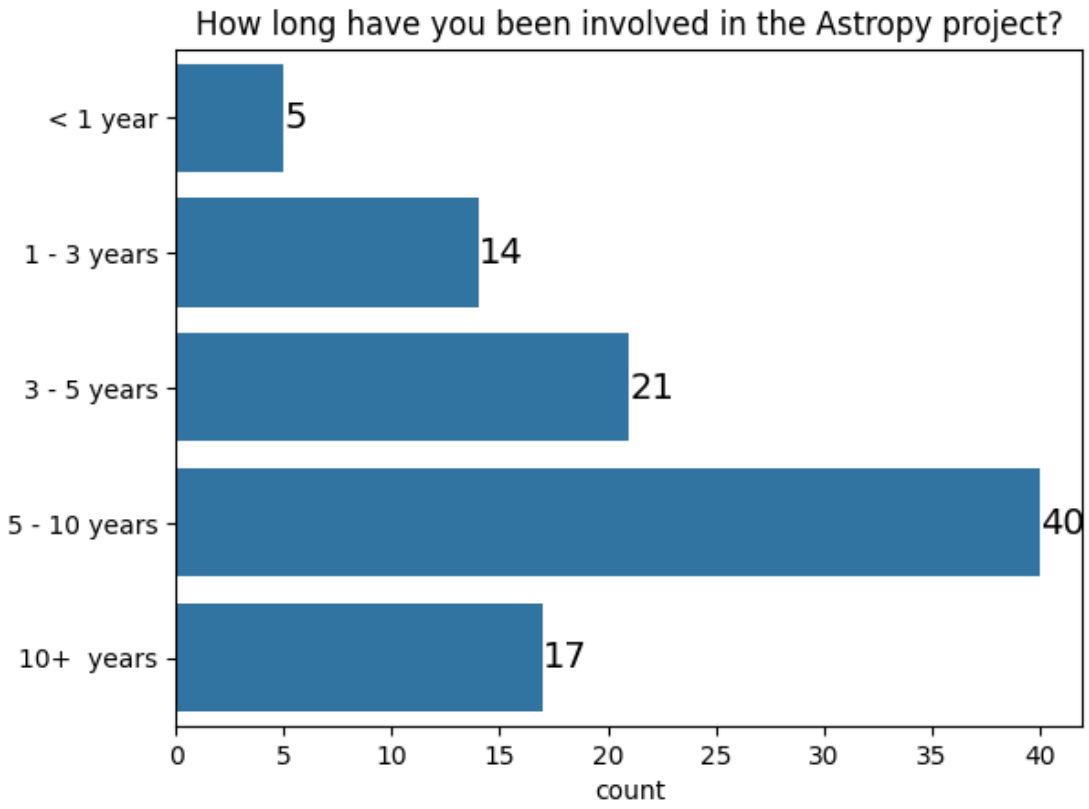
3.2. Age Distribution

Strong academic software communities have a mix of early, mid and late career participation. In this survey we found that the folks who responded to the survey were distributed strongly towards early to mid career representation, but with some participation in very early and late career age cohorts.



3.3. Involvement in Astropy

The length of involvement shows over half (57) of respondents have been involved for five years or more, with 40 having been involved for less than five years. For a community looking to constantly re-charge and grow its long-term utility and appeal it is important to continue to be inviting new community members. Continuing to fill the pipeline with participants who have not been involved for very long can help to build long-term participation.



3.4. Location and Time Zones

To get a sense of geographic distribution of participants we asked both for physical location and time zone. A majority of 69% of respondents are located in one of the five North American major Time Zones (Eastern, Central, Mountain, Pacific, Arizona).

Next in order was European time zones with a collective 20% across Europe. The rest of the time zones (~10%) are spread across other parts of the world, mostly in Asia. From the time zone data, it appears that the community could target growth in Asian time zones, as there is a large global population there.

3.5. Feedback to Leadership

We were interested to know what percentage of survey respondents had engaged with Astropy leadership in the past. From our survey response, about 33% of community members report that they have given feedback to the leadership of Astropy. It is also

worth noting that 12 respondents (~10%) reported they had at one time held a leadership position in Astropy.

4. Participation in Astropy

Our second research question asked "How do community members participate in Astropy?" We wanted to know how people used Astropy resources and community, what they used it for beyond just the software products.

This section is divided into two subsections a) positive attributes of Astropy and b) data on how people reported engaging with Astropy.

4.1. Positive Attributes of Astropy

We asked respondents in a free response survey question to tell us what they liked about Astropy and several themes emerged.

The words that we saw respondents repeatedly use to describe Astropy were: friendly, collaborative, welcoming, inclusive, useful, helpful, open, responsive, knowledgeable, thoughtful, responsive & supportive.

Generally people found Astropy to find high quality, well documented software which is useful for their work. They like how open, friendly and welcoming the community is, mentioning how supportive the feedback is and that leadership is strong and that there is a focus on learning.

4.1.1. High Quality Software

Respondents said that Astropy creates high quality, well-documented software as one of the reasons they like the organization.

> Amazing, high quality, well tested software. Much of it is built by early career researchers who deserve better rewards!
>
> It generates high-quality astronomy software.
>
> Supportive, careful, high quality code.
>
> They write fantastic code.
>
> They are inclusive, thoughtful, and help develop and steward a truly wonderful (useful, user-friendly, powerful, versatile) software product.

4.1.2. Useful

Respondents said that they used Astropy software in their work and described it as practical, reliable and useful. Several respondents mention that it is a core part of the work they do.

> Commitment to standardizing useful software
>
> It is a dedicated community that has created a very strong, reliable software base! Makes it so easy to develop new tools on which my research group relies extensively.
>
> I like how practical the package is, it's all but central to all my work now.
>
> I use Astropy, so I like the community that maintains it.
>
> Very welcoming, nice group of people that are focused on making a practical tool for astronomy

4.1.3. Openness

Another theme was the importance of the software being open. This was often paired with a comment about kindness or the helpfulness of the people in the organization.

> Super open, collaborative, helpful folks. It attracts the best and kindest astronomers in the field.
>
> I like open source software, have a background in Astronomy and look forward to contributing more after retiring at the end of the month
>
> It's open source and most of the people are helpful and have similar kinds of coding/software problems as me

4.1.4. Friendly

The word "friendly" was used often in describing Astropy largely in terms of the friendliness of the community.

> Friendly and shared interests
>
> Always helpful and friendly.
>
> It's a friendly, inclusive community that [creates] useful, pragmatic software development standards.

4.1.5. Welcoming Community

Survey respondents talked about the inclusive and welcoming nature of the community when describing what they like about Astropy. In particular, people commented on the way that the community makes it possible for beginners or people who are new to be included.

> It's a community that is very supportive and welcoming of people who are starting out as users/contributors

> I appreciate how inclusive it is. It has a great group of contributors.

> It's a lot of people who have similar use cases and very different solutions. A large group of people

> Since I joined… I was welcomed into the community, and worked my way up to leadership positions that align with my values.

4.1.6. Constructive Feedback and Support

Another theme was the sense that the community offers helpful and constructive responses to questions as well as feedback and support that is helpful and friendly.

> Friendly response to first contributors. Generally a real attempt to be constructive in PR review (and keep a sense of humor, especially pllim; thanks!!)

> On the FB group I've been floored by the way everyone is respectful to questioners, even if they approach with little prior knowledge. I am so, so grateful for everyone involved in Astropy development - it has absolutely transformed my work from IDL days.

> Most of my interactions with the broader Astropy community have been supportive, even including code reviews.

> You can ask questions and people are prompt to give feedback.

> I think Astropy pundits are inclined to help out with user questions.

4.1.7. Leadership

Respondents described the leadership of Astropy as transparent and well organized.

> I think the decisions made by the community and those in leadership positions are done in a way that is as transparent as is reasonable.
>
> thought has been put into the collaboration and contribution guidelines
>
> It's active and continues to put in effort to improve engagement and its structure as an organization.

4.1.8. Other

Additional comments responding to what people liked about Astropy are:

> Interesting discussions involving celestial mechanics.
>
> Supportive, great resources for students

4.2. How to Engage with Astropy

We asked a series of questions designed to gather data on the specific ways that respondents engaged with Astropy, these are summarized below. Specifically we looked at respondent's engagement with GitHub and software development, documentation and educational modules and how they used Astropy in their work.

4.2.1. GitHub and Software Development

We wanted to get a sense of how respondents had personally engaged with GitHub. We asked if respondents had opened an issue on GitHub, 51% reported not having opened an issue, 49% had either in the past year or earlier.

We also asked if respondents had entered comments on an existing issue. 65% had not commented on an already open issue, with 25% having responded to an issue in the last year, and about 10% having done so greater than a year ago.

When asked if respondents had contributed code to Astropy, 67% have not, while 33% had, 20% in the past year, and 13% greater than a year ago.

When asked if respondents contribute to other software that is dependent upon Astropy, 55% of respondents reported having done so in the past year, with a further 6% having done so more than a year ago. Leaving 39% of respondents who had not.

When asked about contributing to or maintaining affiliated packages, 24% had done so, 19% in the past year, and 5% more than a year ago. Most respondents, 76% report they have never done so.

4.2.2. Documentation and Educational Modules

With the exception of two respondents, every respondent had used the Astropy documentation in the past. Most, (n=90) had used the documentation in the last year.

Similarly we asked about the use of Astropy tutorials that are available through the https://learn.astropy.org website. 51 respondents had used these in the last year, and 29 had more than a year ago. Only 13 had never used the Astropy tutorials.

We asked about the use of Astropy developed materials in teaching activities, and 31 respondents had in the last year, and 18 more than a year ago. 43 respondents had not used the tutorials in teaching situations.

We also asked if respondents had ever attended an in-person Astropy workshop, or other in person event. 68% had never attended an in-person Astropy event, while 19% had more than a year ago, and 13% in the last year.

4.2.3. Astropy at Work

When asked if Astropy software is used in the course of people's work, 91 had in the last year, 2 more than a year ago and only 3 respondents had not.

5. Communication Channels

We wanted to get a better understanding of the way that people used Astropy's communication channels. To do this we asked both specific questions as well as open ended questions. Both are summarized here.

5.1. Facebook, Slack, Discourse Engagement

When we asked people directly if they were part of the Python Users's in Astronomy Facebook group, a group with 7,300 members. From our survey respondents, 57% were not members, 24% had used the group in the past year, and 19% had more than a year ago.

We similarly asked about Slack community participation, 58% had not used Slack at all, 34% had in the past year, and 8% had more than a year ago.

When asked about the Open Astronomy Discourse, 80% had not used it, the remaining 20% had in the past, 13% in the past year, and 7% more than a year ago.

5.2. Benefits of Online Forums

We asked respondents what the benefits were for engaging with online forums and how they used them. Respondents told us that they used the forums to get answers to questions, to learn about technical updates as well as to avoid challenges with updates or as an alternative to opening a Github issue. Some discussed forums as a place to see the transparency of the development process or to understand the use cases for the software. Some also commented that they used the forums for learning materials. Others responded that they did not know that Astropy online forums existed.

Below we've summarized the themes from their responses with representative quotes.

5.2.1. Getting Answers

Respondents talked about one of the benefits of the online forums is that they are a place to give or receive specific, tailored answers to questions. Folks called it an "informal help desk" and a place to get expert advice, help with problems, as well as a place to network and communicate with the community.

> Ability to get expert answers to very astro-specific questions that are hard to ask on more general python forums
>
> Discourse is where we would like users to post their questions so they are retrievable by search engines.
>
> a friendly place to engage with a quick response time
>
> I don't benefit from them. The only reason I joined is to help answer questions about the bit I maintain in my affiliated package.
>
> I get to communicate with the community who use Astropy and might have different solutions to problems that I have as a user. Usually, Astropy's devs are too busy to answer questions but having online forums allows me to unstick myself through the community.
>
> I learn new stuff and occasionally get to help other people with their problems.
>
> I use it very effectively as an online informal help desk
>
> It's a great place to get advice on astronomy/Astropy specific problems/issues. Similar to StackExchange but focused.
>
> Networking, helping people, solving my problems.
>
> Questions and answers on best practices, how-to's, confusing errors

Specifically some folks turned to the Slack to get these answers and saw it as the place to communicate with developers.

> I really appreciate the Slack group to ask questions of the developers and users on capabilities and how to implement astropy in my work.
>
> Slack has proven to be the most effective way to reach some developers. Unfortunately not 100% of devs use Slack frequently, so some folks are still hard to reach.
>
> Slack is a quick way to ask questions of, and exchange news with, project members.

> Slack: communication with other developers. Discourse: communication with Bob developer users

5.2.2. Technical Updates

Many respondents appreciate the ability to keep abreast of what is going on in the community. From seeing bug reports to workshop planning and more in-depth conversations. Some community members said they wanted to avoid things breaking due to updates or bug fixes and they turned to the online forums for that knowledge.

It is clear that survey respondents see online forums as a place to keep updated on what is happening with Astropy. A lot of community building and networking take place in these channels.

> Seeing latest updates on Astropy package.

> Advertising new features in releases

> Facebook group posts a lot of useful information

> Keeping informed about development, get a feeling of the ways that the people use astropy, learn about other people problems…

> Recent announcements, bug reports, feature freezes, etc.

> Looking out for events, jobs or opportunities to join or contribute to a software project in astronomy.

> Any new issues with using astropy on new hardware such as the macintosh m1, m2, etc.

Again, respondents saw Slack as the place to keep up with news, announcements, project news and updates.

> Slack is very useful for keeping up with the project, and we use it for workshop planning.

> Slack is a good way to communicate about workshops and project news.

> For Slack, it mostly helps to keep track of announcements.

5.2.3. Alternative to Github Issues

Some specifically mentioned that they use these forums as an alternative to Github issues.

> I use slack for conversations that don't fit into github issues.

> Quick feedback on questions or discussions that don't warrant a Github issue

5.2.4. Transparency of Technical Development

Some also commented that being in these forums allowed them to see how the developer ecosystem worked.

> A view into the vibrant developer ecosystem of this indispensable software package

> Examples of the kinds of questions others are asking

5.2.5. Use Cases

Some also saw the forums as a good place to look for use cases and ways that people are using their code to solve problems. In essence, this becomes a place for developers to see real life use cases of the technology.

> Use case examples

> For discourse, it can help find similar use cases or issues (in addition to Github).

> I get to see how others are using their code to solve problems, a great learning opportunity.

> I keep myself updated about the use cases and issues from multiple users.

> New usage ideas

5.2.6. Learning Via Community

Some said that online forums were a place where they learned to use Astropy and found resources they needed.

> I learnt how to use Astropy

> Pointers to resources

5.2.7. Not Aware

Several of the people that were surveyed did not know that the online forums existed or did not use the forums. This will also be reflected int he next question around improving online forums.

> I am not involved and/or not aware they existed
>
> I can not use slack due to fees, not a Facebook member
>
> I currently don't use them
>
> I do not use these, in particular, I am not a facebook member
>
> I don't use these; I have too many other forums to keep up with
>
> N/A - I have no interest in more distractions, so am not part of online forums
>
> I haven't looked at Discourse or Facebook very often.

5.3. Improvements to Online Forums

When asked what survey respondents thought would improve online forums, we saw several ways that these spaces might be improved.

Respondents commented that the communities seem fragmented, that there is a challenge of needing spaces for users and also for developers, they also commented on specific issues with Discourse, Slack, Facebook and other sites. We also heard that folks were not aware of some of the online forums, that they want more resources for beginners/new users and searchability of the forums is a priority.

5.3.1. Fragmentation of Forums

Respondents mentioned that there is a fragmentation in the Astropy online communities and indicated a need to make clearer what each forum is for and where information is located.

> I would like to know where is the community discussion now. Fragmentation is a problem but I do not know how to solve it.
>
> I would get more developers looking at Discourse and I would make notifications more apparent. Slack is pretty good as-is but I would try to move users to Discourse so it could be more like a Stack Overflow site.

> Focus on supporting one as a primary community hub and make it clear who it's for; often I feel like Astropy online discussions are only for serious developers/contributors of record, not users stumbling through trying to do a coordinate crossmatch for the first time. I vote Slack!
>
> More general information posted. General updates, etc.

5.3.2. Forums for Users vs. Developers

Specifically, the fragmentation was between user forums and developer forums and some folks had suggestions on how to mitigate the different needs of each community.

> it would be better to distill forums into just two: one for developers, one for users. the current slack fits the bill for developers and is very active. i would recommend choosing between discourse and facebook rather than supporting both.
>
> would like to have a kind of ”users forum” rather than be included in the development discussions
>
> More engagement from developers and users on Discourse
>
> it's good to be able to contribute to the discussion, but a lot of discussion is also too technical for me

5.3.3. Discourse

Some folks had specific thoughts about the use of Discourse and indicated that it has less people who are active on the forum.

> Discourse could, in principle, be a nice resource, but is under-utilized; it mostly seems to be used as a low-traffic tech support forum, which is a missed opportunity.
>
> Need more users on discourse to teach critical mass
>
> More engagement from developers and users on Discourse
>
> I would try to steer user questions towards Discourse and I would set up better notifications for Discourse. Discourse is not active and the interface does not invite engagement.

5.3.4. Slack

Opinions about Slack varied. Some indicated that they'd prefer not using it, while others had specific opinions on

> It would be nice to replace Slack by a more open system, but it's not clear that would really get an appropriate head of steam.
>
> I would like to see more general discussion in slack. Everything seems to be very specific
>
> Please avoid using Slack
>
> I think Slack is fine as is.
>
> Nnobody from WCS team participates on Slack.

5.3.5. Facebook, Blue Sky and Twitter

Folks who responded had thoughts about Facebook as well as Blue Sky/Twitter.

> Facebook is an exclusionary walled-garden; there shouldn't be any official presence there.
>
> I am not on Facebook.
>
> Move to bluesky and off of Twitter/x

5.3.6. I Didn't Know

Similar to responses to the previous question, some folks indicated that they did not know about all the forums that are available to Astropy members and indicated they'd like to have information on how to join.

> I was only aware of the Facebook group and not of the other platforms. Making the various ways of discussing topics known would be ideal.
>
> I didn't know there was a slack or discourse! Would love to know how to join those channels.
>
> I didn't even know about Slack, so I need to check that out.

5.3.7. New Users

Respondents said that information about how to join or become involved for new folks would be helpful.

> Clear directions pinned for new users to get involved.

> I think some tutorials or resources for people that may want to get more involved in contributing to astropy project but don't have a background in astronomy or astrophysics but may be coming from a related field, e.g. physics, computer science etc.

5.3.8. Searchability

Some folks also mentioned that a priority was to make sure that the online forums were searchable.

> I would find stackoverflow-style searchable questions + ranked answers more useful than a linear stream of forum discussions.

> Make it more searchable

> The issue with FB is that the search features for past questions aren't great.

> Slack is fine the way it is and I am happy with that except it is not useful as a way to search for code question answers.

5.3.9. Other

Finally we heard a few additional comments: > Use open platforms please.

> It would be nice to see closer ties with the AstroJulia community.

6. Improving Participation

6.1. Change about Astropy

We asked respondents what they would change about Astropy, leaving the question open-ended so as to enable comments on technical, social, or other issues faced by community members. Newcomer issues were a major theme, with several respondents mentioning the desire to have easier entry points for using or contributing to Astropy. Other themes included respondents seeking improvements to the affiliated package and PR processes, expressing desired support for using Astropy in educational settings, and suggesting revisions to community priorities.

6.1.1. Easier Contributions

Respondents described a desire to make contributions to the community easier. In particular, both newcomers and returing community members mentioned not knowing how to make a contribution and seeking more learning opportunities.

> A ”one stop shop” or ”single pager” for new people t learn how astropy works and how to get involved. Ideas such as the first projects tags on github should continue.

> I think the bar for new contributors is still very high. I think ways to make it easier to contribute, either to the core astropy package or to affiliated packages, would be helpful. Some more explanation on new code infrastructure pieces like ruff, black, and type annotations would be helpful

> I would like to be able to engage again but I do not know where.

> I would like to contribute code or documentation, but I find it hard to understand what issues are open, a priority, and something I know how to contribute to.

> Make it easier to contribute

6.1.2. Development of Affiliated Packages

The Astropy community seems to value affiliated packages both for their utility in practice and the experience of developing affiliated packages alongside the community's experts. Still, respondents had several ideas for improvements in affiliated package development and standardization.

> I most want to see us introduce an incubator pathway for developing new tools. This serves a dual-purpose of allowing for nimble creation of new software, as well as providing a platform for drawing-in folks from the "new astropy contributor" phase to the long-term contributor phase.

> We see that hack days can kick-start really useful tools on timescales of days, and full-time positions (like those belonging to folks at STScI) can construct sustainable tools on timescales of months or more. GSoC can do something intermediate, but those positions are focused more on mentorship. Of course, there are plenty tasks to accomplish on the to-do list already. But I worry, for example, that small grants to "explore units compatibility with dask" might be *too* small. Working a few percent over a year might be less efficient than six focused months at a much higher level.

> I know we don't have money to do this right now, but what if we competitively award grants to post-PhD folks to seed projects that could become affiliated packages? We could provide check-ins with liaisons from astropy who work to preserve/enforce interoperability within the ecosystem. And we'd help foster the folks at upper end of the user-to-developer pipeline.

6.1.3. Standards for Affiliated Packages

Several respondents were interested in improved and more clear documentation and standards.

> Better documentation for associated / affiliated projects.

> Clearer documentation (including tutorials) about how to convert an existing package to an Astropy Affiliated package (without assuming the person who wants to do this is already an Astropy developer).

> More standardization and quality control

6.1.4. Support for Non-Astropy Software

Respondents reported some issues with interoperability, offering feedback and ideas around getting support for how to integrate astropy in less-compatible workflows. These community members want to use astropy in more complex environments with other software and "new paradigms" in computing.

> expanded emphasis on astronomical software in general. python is a good solution for many use cases, but not always the optimal one.

> I'd like to see some cross package tutorials, particularly with widely used iterative techniques such as MCMC. I know how to use these types of packages separately, but integrating them correctly is something I struggle with. Particularly with Astropy methods such as the ones in cosmology. The tutorials section is great already, it would just be helpful to include some iterating techniques and how to successfully use them with astropy methods.

> More focus on evolving code to support new paradigms for high-performance computing, like JAX.

6.1.5. Code Quality and Maintenance

There were some concerns about project maintainers prioritizing quality and purity of code over more practical concerns. One respondent suggested that the project assign more people the role of "maintainer". It is clear that community members value code quality and stability of code that comes from the community, but understand the labor demands of these successes.

> I perceive the community to be snobbish about code quality / purity, while at the same time undermining itself with things like cosmetic changes to API options that breaks my code whenever I upgrade to the latest version.

> More maintainers, to lighten the load (astropy core package, but probably true for other parts too)

> Not too much, really. It would be nice to have more highly-qualified developers with free time to dedicate to open issues.

6.1.6. Happy with the current state or personal challenges

Several respondents were comfortable with the way the community is at the moment, while some thought there would be some ways to improve involvement and kindness.

> I know it's not helpful, but I really like the community right now and I don't have any ideas at the moment about how it could be improved.

> I like things the way they are.

> I would like to find time to be more involved.

> Replace Astronomers with kinder and more normal people.

6.1.7. More Support for Education

One respondent expressed a need for a more full curriculum shared by the Astropy community that can help teach astronomy programming with more structure.

> Having more tutorials and perhaps a full curriculum available for instructors to use/adapt for classes would help greatly. Astronomy programming is still taught somewhat ad-hoc at least at my institution.

6.1.8. Support for Early Career Astronomers

Similar to the education support, there was a clear expression by some respondents of a need for more formal ways of learning about and getting credit for high-quality software development.

> I hope we are teaching young astronomers very early how to build, maintain, and contribute code. It was very hard for me to learn at a later career stage.

> Much of it is built by early career researchers who deserve better rewards! But that's not so much a problem in the Astropy community but rather in academia as a whole.

6.1.9. Networking and Jobs

One respondent was interested in seeing more career development opportunities or project collaboration opportunities as part of the community.

> One thing I would like to suggest is showing related job or project opportunities

6.1.10. Faster Response Times

One respondent was concerned about how some GitHub Issues linger unaddressed by the community.

> Better responses to issues raised (often just ignored, even if they are acknowledged issues)

6.1.11. PR Process

There was feedback about the challenges of submitting PRs and the number of comments and changes requested for PRs.

> easier PRs (often excessive commenting and requested changes by dev, making the experience very onerous)

6.2. Barriers to Contribution

We asked participants specifically about barriers they had to using or contributing to the Astropy project and `astropy` software. These barriers included technical, community-related, and broader systemic factors, often related to how software development is (not) credited in academic communities.

Some areas to explore changes in Astropy's approaches to encourging and managing contribution include: evaluating how first contributions take place, identifying when, how, and why potential contributors bow out, and what can be done to remove barriers to the first contribution made in the community.

6.2.1. Git is Intimidating

Looking at the version control software Git, some of the responses talked about how Git itself can be a barrier as it can be intimidating and require some skills that not all beginners have.

> Making a pull request is intimidating, since I usually don't have code that is modular or generalizable enough to become a new feature

> yes, contributing a PR to astropy requires a fairly advanced level of git and github knowledge. this has improved some over the years, but one still has to be aware of what ”rebase” and ”squash” mean.

> see previous answer about being more welcoming of non-expert contributions to github issues and code.

6.2.2. Complexity and Technical Skill

Many responses centred around the sheer complexity of the Astropy software stack, and how that itself was a barrier to entry. Others noted that tools and procedures to make developer's lives better are often not always better for the newcomer.

> Astropy is huge. The project is very daunting to find a place to contribute.
>
> Contributing code to Astropy takes a relatively high degree of technical skill. That makes it more accessible to people who have the free time or resources to acquire that skill.
>
> I haven't tried very hard, but it is sometimes staggering how much complexity goes into contributing to Astropy. I gather that the main dev team is aware of this and is thoughtful about improving accessibility.
>
> Hard to know who is responsible for what parts of the codebase and which parts are "ok" to touch vs "need to be left like that" for... reasons.
>
> We could lower the bar for contributing code by being careful of the barriers that the Python linter "ruff" has introduced.

6.2.3. Knowing Where to Start

A few responses talked about not knowing where to start and how to bring their skills and expertise into the community. It is clear these respondents would like to find ways to contribute, but might need some support in order to be able to do so.

> Knowing where to start contributing!
>
> Lately (last <3 years), it's been difficult to keep up with deprecations & CI updates. I'm constantly being asked to learn new software practices that are not relevant for the software tools themselves. This is fine, I just need help keeping up.
>
> I'm a rubbish coder!

6.2.4. Value of the Work to One's Career

A few responses focused on how their own jobs or careers did not value contribution to open source. This is a common problem in many academic open source domains, and is worth discussing as a community to better understand how the reward structures in Astronomy may not be aligned with work that needs to be done as a broader OSS community.

> It's not counted as valuable work.

> My biggest barrier has been the expectation that the longevity of my career as an astronomer would be at risk if I contributed to astropy as frequently as I wanted. Few things in life are zero-sum, but there's no flexibility on the finite 24 hours in a day. I was cautious about spending time on work in the astropy ecosystem that wouldn't produce a first author paper.

6.2.5. Community

Community members seemed to be looking for more interactive ways to get-to-know others in the community. Some felt like discussions they had been privy to moved to some other platform they weren't aware of at a certain point in time. Others mentioned that being optically focused, they felt a excluded as a radio astronomer.

> As mentioned before the main barrier that I found was to find the community discussion in places where I participate. I tend to avoid privative platforms and I could see how participation in, for example, the email list faded with time. At some point I did not know if people moved somewhere else or something else was happening.

> Sometimes its hard to line up terminology from the radio astronomy community with astropy terminology. It feels very focused on optical astronomy.

> I am not been able to get involved with the astropy project due to lack of interaction with the community. If there's any way to interact with the community, I believe I and many more people will be able to contribute

6.2.6. Documentation

Documentation was observed to be not very accessible to one respondent. Some work to gather user feedback from documentation users might help to develop some guidelines and work sprints on improving documentation in ways that it can become more useful to newcomers.

> Minimal (and somewhat outdated) documentation for creating an Astropy affiliated package; the assumption seemed to be that people doing this would already be very familiar with the Astropy package architecture and procedures, and so no explanation of what anything in the (default) package was for seemed to exist. Consequently, I gave up my attempt to create an affiliated package.

6.2.7. No problems

A few responses have said that their first contributions went very well, and their interactions with maintainers was “lovely”.

> No, my first contribution was last year and I've done a few more since that. Loved all the interactions with the maintainers, they're lovely.

> No, to the contrary: the friendly response to my first issues/PRs is a major reason I got hooked.

Part III.

Recommendations

7. Community Recomendations

We queried Astropy community members to gather their ideas about how to improve community participation and otherwise enhance the project's community climate. Some responses directly addressed the barriers and challenges listed above, noting how the community could be more welcoming toward newcomers and offer accessible entry points for contributing to and interacting with the project. Other respondents suggested more learning opportunities, such as workshops and tutorials, with preference for these opportunities to be available both in-person and virtually.

7.1. Improve Community Participation

Across the responses, one theme stood out: astropy users sometimes doubt their own abilities and value, with multiple respondents reporting that they or other users may not feel "skilled" enough to make meaningful contributions. Although difficult to solve from a structural level, we offer some suggestions later in this document for helping community members overcome this imposter syndrome-like barrier.

7.1.1. Beginner Resources

In any established open source software project, newcomers are often intimidated by the skill and experience of existing community members and feel that they lack the requisite skills to meaningfully contribute to the project.

Astropy users who have not yet crossed the threshold into contributing struggle with many of the same challenges. Respondents routinely mentioned that Astropy newcomers struggle to find ways to contribute that match the skills they bring to the table. In learning science, enabling people to use their existing skills and assimilate into a community of practice is referred to as "legitimate peripheral participation". LPP tasks allow newcomers the space to observe and participate in the work of the community, pick up jargon, and otherwise engage with peers without feeling as if their tasks are so central to the project that failure would be catastrophic.

As one respondent put it, Astropy could be more welcoming of these "non-expert contributions," building on what the project already does well with regard to astropy *users*. Several others echoed this sentiment.

> Be more welcoming of non-expert contributions to code and github issue reports. New contributors can be scared off (or just become frustrated and leave) by the piling on of perfection expectations, i.e. the better being the enemy of the good. In contrast, the community is remarkably patient with newbie questions on how to *use* astropy; the issues I see are with how to contribute to the astropy development which has a much much higher bar.
>
> I think Astropy does many great things; suspect those who don't participate don't feel they have the skills to contribute, and/or feel there isn't enough incentive for them to do so
>
> I guess for someone slightly older like me, I don't always even know where to begin with engaging at a higher level than "user". Any help bridging that gap may encourage more users to engage at a higher level.
>
> Better on-ramps to contributing.

One respondent made a suggestion for how to turn these ideas into action, which we expand upon in the Consultant Recommendations section: > I think that a workshop for new contributors would be very welcome. A newsletter or how-to on the new coding checks like ruff would be helpful.

7.1.2. Contribution List

Beyond newcomer workshops, other respondents suggested lightweight options that in some cases already exist and could benefit from some tweaking. A separate repository for newcomer issues, for example, may help get more contributors on board, particularly if the list could include skills that are required.

> Maintaining a clear list of easy and potentially interesting priority projects with some indication of the skills expected to be required and the expected outcomes would be really helpful.
>
> Having more beginner-friendly tasks/issues tagged on github and advertising those in the docs would help I think.

Similarly, one respondent noted that an increased presence on non-GitHub software platforms could increase the visibility and accessibility of the project: > We should be more active on Stackoverflow and encourage new users to post questions there to build up a nice database of simple questions/answers for new users.

For more experienced users, a more abstract approach could provide challenging and interesting entry points into the community. As one respondent suggested: > Maintain a list somewhere that has a list of questions, each starting with "can astropy...?" Every

item on this list is something that astropy can't yet do. We invite people to tackle things on this list.

Outreach to newcomers could also emphasize that projects like Astropy depend on contributions, not just users:

> Clearly make people aware that software is something to be part of, not just make use of.

7.2. Communication/Community Interaction

Some respondents seemed to be unaware of the various platforms available for communicating with other Astropy community members, suggesting that better advertising of these outlets may help facilitate interactions: > Have a well organized platform where the community can easily interact, discuss issues, suggest improvements that has a low barrier to entry.

7.2.1. Workshops

Across all questions, respondents communicated an appetite for more learning opportunities. Most of these suggestions centred around workshops on various topics (e.g., contributor workshops, demo workshops, coding workshops, and workshops for underrepresented communities):

> I think we could hold contributor workshops or Github workshops at more technical meetings like ADASS.

> More workshops at meetings or stand-alone workshops that show off the capabilities of astropy. Though i know that is a lot of work.

> I would like to see astropy provide more coding ”classes” to help more astronomers contribute.

> Make workshops with the communities you would like to connect.

> Expanding workshops to these targeted communities.

Some community members also suggested more informal, self-directed opportunities for learning: > Monthly live demos / mob coding over Zoom? Office hours, like bring your annoying coding problem that you feel silly for not being able to solve, and we'll make breakout rooms and work on stuff with one another for two hours

The workshops and events that Astropy already offers could also be easier to find, including on the project website: > If there are events, I think it could be helpful on the website to have an upcoming events tab. I see there's past event materials on the Zenodo

page, but it would be nice to also have information on when future events will take place if I don't already know about them.

7.2.2. More Outreach

Beyond workshops, community members suggested other forms of outreach that may help Astropy's community thrive. Educational outreach, for example, could help reach potential users and contributors who are already in an active learning environment: > More outreach to professors and teachers

> Connect with training programs (I'm thinking, e.g., Ada Academy) so folks who are learning software development for the first time are introduced to it

> More outreach activities for astropy is used more in the classroom

> Outreach to undergrad programs?

Outreach could also include conducting research with potential users and contributors in communities outside of Astropy, with a focus on underrepresented groups:
> Surveys like this. Maybe more direct outreach to individual under-represented organizations?

> I think this is already happening, but I think it's important for workshops/conferences to accept participants with a range of experience, so that it's not just the people most likely to have already been introduced to CS in other contexts.

> improved outreach to astronomical communities outside of the US/Europe. the IAU Office of Astronomy for Development would be an excellent resource for this.

> There's no right answer to this but continue to encourage early career scientists especially those from typically marginalized groups to join in the discussions and contribute to the codebase.

> Try to actively enamel non-us students, maybe teach or to astro profs and encourage them to use the astropy discourse for questions their students have, have suddenness answer other students questions there

> Outreach to software teams that use and want to contribute to Astropy but by the nature of their work assignments may never have had time to. Increase outreach to communities outside of Europe & North America.

7.3. Other Suggestions

Additional responses from surveys are listed below:

> Provide more tutorials and use cases.
>
> Explore having regional hubs across the world.
>
> A staggered schedule of at least some meetings to cover a greater range of time zones.
>
> Overall, the astropy community should probably evolve like the code base does, by small "PRs" that incrementally improve things. Don't risk breaking things or pushing people away.
>
> I have a physics (BSc.) background, have interest in astronomy and work as a software developer but it's hard to find problems to solve with astropy software. It may be helpful to have a resource to provide a road map from beginner to increasing use (or contributing) of astropy software, or problem areas to explore.
>
> Would be nice if the astropy community better reflected the diversity of, say, the graduate student body. Possibly the main barrier is people's confidence in their own coding. But for astropy core at least, the state of the package is such that contributions require substantial skills. Possibly, contributing to and writing new tutorials might be a way to help: newcomers know best what tutorials are needed.

7.4. Money

Respondents also had thoughts and suggestions around how Astropy could ask for more money to facilitate these community improvement ideas and otherwise sustain the project.

> Start charging licenses to large universities that use AstroPy in their projects. Disappear randomly from PyPA, switch up the license, add bitcoin farming code or something else (or all three) one random a month a year until funding becomes available and/or contributing to such packages is understood as work.
>
> Shake up the academic funding system to ensure that there are better long-term career options for research software engineers.
>
> Ask big consortia to contribute somehow if they release software built on astropy software?

7.5. It is Good

Finally, some Astropy community members felt that things were going well.

> It appears community participation is about as good as could be expected.
>
> Great engagement already, keep up the good work!

8. Consultant Recommendations

We synthesized the above responses and drew upon our experience working in OSS communities to develop concrete yet flexible recommendations for the Astropy community. Addressing the most prominent theme across all of our work–newcomers' struggle to cross the threshold from user to contributor–was our primary focus in developing the recommendations. We also sought to develop recommendations that would help the community manager to better accommodate community members from non-U.S. and non-European countries, to adapt communication strategies to community needs, and to understand and shape the culture of the project.

8.1. Help newcomers acclimate

As mentioned in multiple sections above, joining an OSS project can be an intimidating and confusing process. Project leadership, staff, and experienced community members can make this process easier to navigate in a number of ways, many of which are low-cost and relatively simple to implement.

- **Continue to be welcoming**: At the abstract level, a community should be welcoming when a newcomer first encounters project members. If a newcomer joins Slack, for example, a welcoming message from the community manager and acknowledgment from some of the experienced community members can encourage continued engagement and contribution. In a study of newcomer integration to three OSS projects, the authors found that "almost all non returning newcomers can be attributed to receiving no reply or a condescending reply from the community."

Likewise, tone and approach to answering newcomer questions is essential to encouraging newcomers to remain in the community. While core contributors, maintainers, and other experienced community members are almost always busy and need to be efficient, taking the time to interact with care and intentionality can facilitate a healthier climate and should be encouraged by project leadership. Astropy's contribution guide does a great job of articulating these values; occasionally referring experienced community members back to this document to refresh their memories and helping them develop the interpersonal skills to enact these values could improve things even further.

- **Evaluate project-person fit**: Developing ways to quickly evaluate whether a person's skills and interests are a good fit for the community helps to ensure that most community members are active and engaged participants rather than passive and resigned observers. A community manager can aid in this process by developing rubrics and using tools like My GitHub Resume, but a curated list of issues and project needs suited to different skills (akin to LibreOffice's hack list) can make the evaluation process less time-intensive for project staff.
- **Make it easy to find communication channels**: Some respondents in our survey and interviews noted that they didn't know about all of the various ways they can engage with other community members. As one participant recommended, adding these options to the project's documentation and to its website would help newcomers find the appropriate places to ask and answer questions, get to know other community members, and learn about upcoming events and opportunities.
- **Identify good first contributions**: A well-maintained list of good first issues is essential to helping newcomers feel welcome to contribute. Astropy does this well using the label feature on GitHub, but may benefit from advertising these opportunities on a regular basis (e.g., in monthly newsletters, on Slack, or in non-Astropy forums). Likewise, Astropy should ensure that there are multiple good first issues labeled at any given time so that potential contributors can have a better chance of finding an issue suited to their abilities.

8.2. Develop and visualize user-to-contributor pipelines

All OSS projects tend to struggle with getting users across the threshold to being contributors. We encourage Astropy and its community manager to develop and visualize pathways to becoming a contributor so that newcomers and long time users can easily see the steps they need to take to make contributions. This effort begins with identifying the common personas of existing community members. For example:

- Novice user (e.g., students)
- Engaged user (e.g., researchers who use Astropy in their work)
- User-novice contributor (e.g., users who contribute to documentation)
- Developers and Maintainers
  - Junior
  - Intermediate
  - Senior

Building out these archetypes with the skills required to move between them–perhaps by using skill and mastery rubrics–and making these visualizations available to community members alongside learning resources can make the pathway less daunting for those who wish to contribute more to the project.

It is important to develop these pathways in such a way that does not inhibit new, unforeseen talent flowing into the community. Across our research with Astropy and other communities, we've seen how the "old guard" can preference skills and approaches that have been valuable in the past (and may remain valuable today) to the exclusion of different abilities that may add value. This issue may become increasingly important as advances in other domains (e.g., AI and machine learning) filter into the astronomy community.

8.3. Make existing resources visible

As mentioned with communication channels, Astropy already has robust infrastructure in place for community members to communicate, learn, and understand project expectations. These resources, however, are not always easy to find. It could be beneficial to consider how these resources can be advertised in commonly-viewed places: in project documentation; on the project website; pinned in popular Slack channels or Discourse threads; and/or in dedicated GitHub repos. We identified several resources that, to date, are not particularly easy to find:

- Communication channel options (e.g., how to get added to Slack)
- Astropy Learn modules
- Code of Conduct reporting mechanisms (more on this in the DEI and CoC report)
- In-person events (formal and informal opportunities to connect)
- Good first issues (see above section)

8.4. Improving culture

Most community members we interacted with throughout our research and consulting were happy with the climate and culture of the project. There are, however, opportunities to improve this further and ensure that community members remain engaged while moving from user to contributor.

- Engage community in synchronous online events / community calls that vary in time zone feasibility
- Regularly share priority channels across other channels (i.e., advertise the conversations happening on Slack via email list, point out the email list via Slack / Facebook, etc.)
- Make priorities for new skills and approaches clear (e.g., send out requests for varied expertise, such as "Do you or someone you know want to help Astropy better implement linter functionality?")
- Make more direct connections to communities we want to see better represented (e.g., HBCUs, citizen scientists, non-U.S./European users and contributors)

- Develop standard welcoming processes for newcomers, including messages from the community manager, lists of resources, etc.
- Develop and advertise ways to make improvement suggestions to the CoCo and other leadership

Overall, Astropy is in a healthy and exciting position with its community development efforts. The community manager has the combination of technical knowledge and social skills to make a definitive, sustained impact on the health of the community, both in tracking and evaluating engagement and in fostering productive communication among Astropy members. With continued support for regular introspection (e.g., surveys, interviews, and engagement tracking), we believe Astropy will remain a model community for the broader OSS community while moving toward its technical goals.

A. References and Suggested Reading

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B. Survey Questions

B.1. Astropy Community Engagement Survey

We'd like to know how you engage with the Astropy project community and what we can do better going forward. We appreciate your honest response.

B.1.1. How long have you been involved with the Astropy Project?

Involvement includes members of the community, users or developers of materials/software and organizational leadership.

a) <1 year

b) 1 - 3 years

c) 3 - 5 years

d) 5-10 years

e) 10+ years

B.1.2. Which of the following are ways you currently prefer to engage with the Astropy Project?

a) Email newsletter

b) Discourse

c) Slack

d) GitHub

e) Twitter/X

f) Facebook

g) In-person events (e.g. conferences)

h) other

B.1.3. Which of the following are ways you would like to engage with the Astropy Project?

a) Email newsletter

b) Discourse

c) Slack

d) GitHub

e) Twitter/X

f) Bluesky

g) Mastodon

h) Facebook

i) In-person events (e.g. conferences)

j) other

B.1.4. Materials: Please indicate your response to each statement about your engagement with the Astropy Project?

a) I did this in the past year

b) I did this more than a year ago

c) I have not done this or not applicable

- I read Astropy docs.
- I use Astropy software or resources for my job.
- I use Astropy software or resources for fun/hobby.
- I have learned from Astropy's tutorials.
- I have used Astropy tutorials in my teaching/mentoring.

B.1.5. Software: Please indicate your response to each statement about your engagement with the Astropy Project?

a) I did this in the past year

b) I did this more than a year ago

c) I have not done this or not applicable

- I have opened issues on the Astropy GitHub.
- I have responded to issues on the Astropy GitHub.
- I contributed code to Astropy.
- I contributed to or maintained an affiliated Astropy package or software.
- I contributed to or maintained a software package that is dependent on Astropy.
- I have attended an Astropy Workshop or other in person event.
- I hold/have held a leadership position at Astropy.

B.1.6. Online Forums: Please indicate your response to each statement about your engagement with the Astropy Project?

a) I did this in the past year

b) I did this more than a year ago

c) I have not done this or not applicable

- I am a member of the Facebook group Python Users in Astronomy.
- I am a member of the Astropy Slack.
- I am a member of the Open Astronomy Discourse.

B.1.7. What benefits, if any, do you get from Astropy's online forums such as Discourse, Facebook or Slack?

Free text response

B.1.8. What improvements would you make to Astropy's online forums such as Discourse, Facebook or Slack?

Free text response

B.1.9. What do you like about the Astropy community?

Free text response

B.1.10. What would you like to see change about the Astropy community?

Free text response

B.1.11. How do you think the Astropy project could improve community participation?

Free text response

B.1.12. What advice would you offer to increase diversity, equity and inclusion in the Astropy community?

Free text response

B.1.13. Have you faced any barriers to using or contributing to Astropy software? If so, what were those barriers?

Free text response

B.1.14. Have you ever offered feedback to Astropy leadership, developers or

maintainers?

a) Yes
b) No

If Yes,

B.1.15. How did you offer this feedback?

a) Via email

b) Via Slack
c) Via social media

d) Via GitHub issues

e) In person

f) other

B.1.16. What was the nature of your feedback?

a) Technical (e.g. code, infrastructure, design)

b) social (e.g.community dynamics)

c) other

B.1.17. Is the work you do to make a living related to the field of astronomy?

a)Yes
b) No
c) Unsure

If No,

B.1.18. What industry do you work in?

Free text

B.1.19. How old are you?

a) 25 or under

b) 26-35

c) 36-45

d) 46-55

e) 56-65

f) Over 65

B.1.20. Where are you located?

Please share your city, state, country (e.g. Columbus, Ohio, USA or Paris, France)

Free text

B.1.21. What time zone are you in?

List of global time zones

B.1.22. We are doing research on diversity, equity and inclusion in the Astropy community and are looking for folks to interview. Are you open to being contacted for this research?

a) yes

b) no

c) unsure

If yes,

B.1.23. Please share your email address so that we can contact you to do an interview about diversity equity and inclusion in Astropy.

Email

B.1.24. Is there anything else you would like to share?

Free text response