

## THE COSMIC CAST: COMMUNICATING PLANETARY SCIENCES TO GENERAL AUDIENCES

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**Introduction:** Since the turn of the millennium, podcasts have served as a free medium to engage large global audiences with science. There has been an exponential growth of science podcasts between 2010 and 2018, 77% of which target public audiences [1]. Podcasts, by their very nature, are unconstrained by demographic or geographical restrictions. As such, they have the potential to make publicly funded science accessible to many more people than are reached by in-person events commonly organized by universities.

Despite this potential, there is currently a dearth of planetary science focused podcasts. Out of 952 active podcasts surveyed by [1] in 2019, 68% are described as ‘general science’, physics-focused, or biology-focused. There are many subject areas that are under-represented. Notably, earth and planetary sciences only make up 2% of active podcasts and chemistry makes up 3%. Despite these low numbers, we feel there is a demand for content about these comparably unrepresented subjects. This is evidenced by the popularity of video channels about these subjects on the YouTube platform (developed by YouTube LLC). For instance, the University of Nottingham (UK), produces a very successful chemistry channel (Periodic Videos, [2]) which, as of December 2019, has 1.28M subscribers and over 200M views across the channel. Furthermore, planetary science has proven itself to be a mainstream topic of interest through the 2019 BBC television series ‘The Planets’, which amassed 3.2M views within the UK for its first episode [3]. In this contribution we hope to highlight the potential of planetary science podcasts as an effective outreach tool by exploring the impact that our own podcast, *The Cosmic Cast*, has had.

**Approach:** After lamenting the absence of planetary science podcasts that discuss sample-focused research, we established our own at the University of Manchester. Since February 2019, we have produced weekly episodes with a target audience of a high-school educated member of the public who is interested in science. We have focused our efforts on YouTube as the primary host for *The Cosmic Cast* [4], although it is also available from a selection of other media platforms such as Apple Podcasts (developed by Apple Inc.), and Spotify (developed by Spotify Technology S.A.). A unique advantage of YouTube is the ability for the audience to leave feedback or ask questions on individual episodes. Additionally, we are able

to supplement our podcasts with videos where visuals better suit a topic of interest.

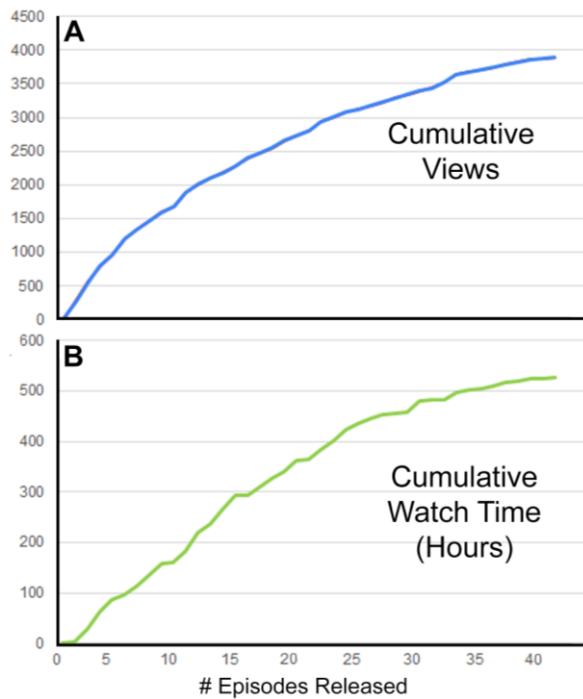
Key drivers of audience enjoyment and podcast longevity are based around creator-audience engagements [5]. To this end, we have made use of our research group’s existing outreach frame-work (under the brand of ‘Earth and Solar System’ [6]) using Twitter and Facebook pages to publicize episodes and to solicit questions for regular ‘Q&A’ episodes.

Based on a data set collected in 2009, the average person spends ~30 minutes listening to individual podcasts [7]. As such, we aim to keep each episode to around 30 minutes in length, in order to maximize listener retention. We also aim to make each episode more conversational in style, to encourage our content to be as accessible as possible to the widest range of demographics. More formal styles of programming historically associated with science content (e.g., BBC Radio 4 (UK); National Public Radio (USA)) tend to have an older average listener age of 56 and 55 respectively [8,9], whereas in 2019 49% of podcast listeners were under 35 [10].

Topics for episodes to date have spanned a wide range of themes, reflecting the diverse research interests of the Earth Sciences department at the University of Manchester. We encouraged faculty members to discuss interesting field work or newly published papers; topics range from meteorite hunting in Antarctica [11] to lunar *in situ* resource utilization [12]. We have also encouraged researchers visiting the department to use the podcast as a platform to talk about their work.

In addition to science content, we have made a conscious effort to ask guests about their career paths and talk about some of the challenges associated with an academic career. We feel that this is an important topic for making the academic process as accessible and as transparent as possible.

**Impact:** Over 10 months we have amassed a combined total of 3891 views, equaling 527 hours of listening time (Fig. 1a, b). Our audience is predominantly concentrated in the UK and the USA (94.7 % of total views), reflecting the fact *The Cosmic Cast* is an English-speaking podcast. Despite this, we have also reached people in countries such as Germany, Italy, Switzerland, Austria, France, Sweden, and Pakistan (5.2 % of total views). Although this represents only a small proportion of our listener base, clearly, these are audiences that we would not be able to reach during the normal in-person outreach events organized by the University of Manchester.



**Figure 1:** Viewing information of *The Cosmic Cast* podcasts compiled from the provided YouTube analytics.

As of December 2019 we have attracted 80 subscribers to our YouTube channel. Despite this relatively low number, over half of our view count from this platform comes from non-subscribed listeners, a common occurrence reported anecdotally by other YouTube creators. Subscribing to a channel is advantageous as new episodes are automatically posted on the subscriber's 'Subscriptions' page.

In total, 67.3 % of views come from clicks or searches on the YouTube platform. This includes people who have viewed episodes and gone on to watch further content based on channel suggestions, demonstrating an engagement with planetary science by this audience. YouTube searches linked to *The Cosmic Cast* views include: "meteorite hunting", "earth", "solar system", "meteorite" and has resulted in 28 hours of watch time. Approximately 15.3 % of traffic comes from external sources as a result of cross-posting links to our associated Earth and Solar System social media accounts (Twitter, Facebook, Instagram etc.). This highlights the benefits of an integrated approach to outreach activities and demonstrates engagement from members of the public who had previously interacted with our social media pages. However, 17.0 % of views come from individuals who, as far as we know, have not previously engaged with our outreach activities.

The ability of YouTube to reach audiences beyond those we currently engage with on social media or at in-person events is the main advantage of this platform. This is due to the recommendation algorithm employed by YouTube, which is designed to keep people engaged on the platform for as long as possible. This is achieved by using machine learning to create personalized recommendations based on the watch histories and patterns of users [13]. In essence, this algorithm enables audiences that are likely to be interested in planetary sciences to be recommended our content. As part of this process, YouTube keeps track of how many times a video was shown to a viewer in their 'Recommendations' or 'Up Next' pages (termed Impressions). Of the 26,446 impressions of our podcasts (Fig. 1c), 7.1 % of people clicked through to watch the episode. This has amounted to a total of 323 hours of watch time by people who may never have been reached through our social media pages.

**Summary:** These metrics demonstrate that engagement with planetary science content produced by the Cosmic Cast team is reaching:

- Individuals who have previously engaged with our in-person outreach activities or social media pages and have retained interest in planetary science.
- Individuals who (as far as we know) have not engaged with our outreach activities or social media pages. This group may also include a subset of individuals who have never previously engaged with planetary science.

Through this analysis, we are able to demonstrate that *The Cosmic Cast* has reached a diverse audience, including individuals who we would never have reached at in-person outreach events. As we continue to produce weekly episodes and as our audience grows, our statistical understanding of *The Cosmic Cast's* impact will also improve.

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