

# Exploring how physics and astronomy graduate programs describe their culture using natural language processing

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## Background

- There are over 300 graduate physics and astronomy programs in the United States that prospective applicants need to choose between. [1,2]
- Online resources are one of the most influential recruiting tools departments have available. [3]
- Prospective applicants are often interested in what it would be like to be a student in the department. [3]
- Broadly can think of what it would be like to be a student in the department as what is the culture and climate of the department.
- *So, how do departments describe their climate and culture to prospective applicants?*

## Data and Methods

- Aggregate departmental culture statements from the 98 physics and astronomy programs with one listed on the American Institute of Physics' GradSchoolShopper platform [4].
- Remove “stop words” like “the”, “a”, and “or” as well as words that appeared in most statements like “physics” “department” and “research”.
- Use Latent Dirichlet Allocation, a natural language processing algorithm, to find topics frequently mentioned in the statements [5].
- Vary the number of topics and the amount of overlap between the topics to find the “best model”.

## Physics and astronomy departmental culture statements focused around six topics:

### 1) Formal departmental research and mixer events

Common words	Distribution
event	0.034
weekly	0.033
colloquium	0.032
social	0.031
seminar	0.028

*“Numerous events and informal talks are held each week presenting current topics and emerging research that bring together students, faculty, scientists, and post-docs as an intellectual community”* - Great Lakes University

### 2) Diversity and inclusion

Common words	Distribution
program	0.034
science	0.028
diversity	0.025
experience	0.024
mentor	0.024

*“As a department, we are committed to fighting conscious and unconscious discrimination within physics and astronomy and in the broader world... our community is culturally diverse, with students from all over the world and an international faculty representing North and South America, Africa, Asia, and Europe.”* – Southeastern University

### 3) Research opportunities and recognition

Common words	Distribution
program	0.041
science	0.035
university	0.032
include	0.030
national	0.021

*“The department boasts outstanding research programs in theoretical and experimental particle physics, astrophysics and cosmology, and condensed matter physics... the recent [National Research Council] rankings of Physics departments ranked [our university] among top Physics Departments in the U.S. (along with several other [university] science departments), and in recent years, [university] faculty have won numerous major awards”* – Western University

### 4) Opportunities provided by university or location

Common words	Distribution
small	0.041
large	0.030
opportunity	0.029
university	0.021
class	0.020

*“[University] is home to SURF [Sanford Underground Research Facility], the US's prime deep underground research facility ... [the city of the university] is host to the National Music Museum, boasts an active community life, and is located about two miles from the Missouri River enabling it to offer a broad range of outdoor recreational opportunities.”* – Great Plains University

### 5) Student organizations and committees in the department

Common words	Distribution
group	0.035
club	0.029
event	0.024
activity	0.024
social	0.023

*“Our graduate students enjoy shared governance in our department, and serve on major departmental committees and faculty search committees. Our GPSI graduate-student group serves as an effective organization to represent the needs, concerns, and activities of our graduate students both within our department and within the broader University. We also have active Women in Physics group and Lunar Sooners education/public outreach groups.”* – Southwestern University

### 6) Departmental community and social events

Common words	Distribution
school	0.039
woman	0.032
group	0.027
member	0.023
area	0.022

*“[The physics graduate student organizations] host activities such as coffee hours, game nights, hikes, and holiday parties”* – North Great Lakes University

## What’s next?

This work captures the department side, but not the applicant’s. Therefore, future work can examine how applicants make use of these statements.

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## References

[1] Nicholson, S., & Mulvey, P. J. (2023). Roster of physics departments with enrollment and degree data, 2022. AIP Report.  
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