# MASTER SEMINAR
# GREAT DEBATES IN GALAXY EVOLUTION
# HEIDELBERG UNIVERSITY SS23

Lecturer: Kathryn Kreckel - kathryn.kreckel@uni-heidelberg.de

# About me : Kathryn Kreckel



- **My role:** **Research Group Leader** at ARI/ZAH, focused on Star Formation and the Baryon Cycle in Nearby Galaxies

- **My research:**
My group carries out observational studies of nearby galaxies, focusing on how the interstellar medium (ISM; gas & dust) acts to regulate the star formation process.

  Recently, we have focused on using the ionized ISM to constrain the gas phase abundances and other physical conditions of the ISM.

  We are predominantly using optical integral field unit (IFU) spectroscopy obtained at the 8m VLT to study the emission lines and stellar populations in galaxies. Within the PHANGS collaboration, we compare these results with ALMA studies of the molecular gas and HST studies of the young stellar clusters, to obtain a full picture of the baryon cycle.

- **My geographical trajectory:**
UC Berkeley (undergrad), Columbia University (MS, PhD), MPIA (postdoc)

# Plan for Today

- General layout of the Course

- Distribution of topics and presentation dates

- How to research a topic
- How to read a paper
- How to give a good talk
- How to write a report

# Course Practicalities

- **Dates and Times:** Weds 09:15-10:45 SS23 (19/04-19/07)

- **Location:** ARI (Mönchhofstr. 12-14), 1st floor seminar room

- **Language:** English

- **Requirements for credits for Master students:**
  - 45-minute seminar + 45 minutes discussion
  - 90% attendance and participation => no more than 1 week missed
  - 10-page final report

# Course Goals

(in no particular order)

- Develop/Practice your abilities to read papers and extract relevant information

- Develop/Practice your presentation skills

- Learn something about the different science topics

# Course Goals

- Feedback and interaction is **encouraged** and greatly **appreciated**

- This is your class! Feel free to **ask** (after the talks) if something is unclear.

- This is also a place for you to practice asking questions!

- We all learn through mistakes, **constructive** criticism and feedback from peers can help us improve our skills

# Course Workflow

- Each class: 45-min seminar + 30-min discussion + 15-min feedback

- Participation = everyone: one or two questions/feedback


- Preparation:
  - *Topic is chosen/assigned today*
  - *Student starts from provided reading material + individual searches*
  - *Student prepares a layout of the talk*
  - *Student meets with me ~1-2 weeks before the seminar (upon appointment)*
- Seminar:
  - *1 presentation/topic per student, 45 minutes*
- Report:
  - *10 pages in Latex to be submitted 1 week (Wednesday) after the seminar*

# Scope of the Course / Course Concept

■ The strongest and clearest presentations (talks, but also e.g. research proposals, job applications...) set up a clear 'question', and then present a result or proposed path towards a solution

■ Open questions and problems fuel our continued research, the development of new telescopes and instruments, as well as new theories, codes, models and simulations

■ I have tried to structure the topics for this course around canonical 'open questions' in galaxy evolution. Your job is to understand the problem, and present our current outlook on the solution

# Scope of the Course / Course Concept

- The title of this course was inspired by the 1920 "Great Debate" between Shapley and Curtis, where they argued over the "Scale of the Universe"

- Curtis argued that the Universe is composed of many galaxies like our own, which had been identified by astronomers of his time as "spiral nebulae".

- Shapley argued that these "spiral nebulae" were just nearby gas clouds, and that the Universe was composed of only one big Galaxy.

- New observations in the 1920s and 1930s were essential to resolving this question.

# Questions?

# I've talked enough!
# Let's do a round of introductions

- Who has taken Extragalactic Astronomy?

- Who has taken a Cosmology class?

- Who has taken Theoretical Astrophysics?

- Who has taken other Astronomy courses? Which ones?


- Who has already given talks in front of an audience?

# Questions?

# Distribution of Topics

| Topic | Name |
|---|---|
| (Historical) Shapley–Curtis Debate | |
| Missing satellite problem | |
| Cusp-core problem | |
| G dwarf problem | Simran Joharle |
| "Impossibly early galaxy" problem | Hannah Greve |
| Missing baryon problem | |
| Cooling catastrophe | |
| What defines a galaxy? | Michael Huber |
| Co-evolution (or not) of galaxies and SMBHs | Kolja Reuter |
| Angular momentum problem | Lukas Bauer |
| Satellite alignment problem | Jana Wolf |
| How do galaxies get their gas? | Shuverthi De Sarkar |
| Too-big-to-fail problem | |

# Distribution of Topics - Schedule

| Date | Topic | Name |
|------|-------|------|
| April 19 | Intro & 'How to give a good talk' | Kathryn Kreckel |
| April 26 & May 3 | No class (Preparation weeks) | |
| May 10 | No class | |
| May 17 | How do galaxies get their gas? | Shuverthi De Sarkar |
| May 24 | Angular Momentum Problem | Lukas Bauer |
| May 31 | No class | |
| June 7 | No class | |
| June 14 | Satellite alignment problem | Jana Wolf |
| June 21 | G Dwarf Problem | Simran Joharle |
| June 28 | "Impossibly early galaxy" problem | Hannah Greve |
| July 5 | Co-evolution (or not) of galaxies and SMBHs | Kolja Reuter |
| July 12 | What defines a galaxy? | Michael Huber |
| July 19 | No class (Makeup week) | |

# How to research a topic

- Resource Types:
  - Published reviews: generally summaries of the state-of-the-art research in a particular (sub)topic. Almost text-book style.
  - Published papers: Peer-reviewed articles on a very specific project / science question. Astronomy Journals with high impact factors: Monthly Notices of the Royal Astronomical Society (MNRAS), The Astrophysical Journal (ApJ), Astronomy & Astrophysics (A&A), Nature, Nature Astronomy, Science
  - Conference Proceedings / Papers in review: unpublished or not yet published resources
  - Book (Chapters)

# How to research a topic

- Resource Databases:
  - *ADS: https://ui.adsabs.harvard.edu*
  - *Search papers by author, year, keywords etc.*
  - *Links to published paper versions (sometimes behind paywall —> Uni VPN!*
  - *Links to arxiv pdfs (open source copies of published papers)*
  - *Option to create libraries, set up email notifications, link to ORCID, export citations, explore metrics etc.*
  - *Most links related to your topic are ADS links*
- arXiv: https://arxiv.org/archive/astro-ph

# How to research a topic

- NASA ADS demo

# Questions?

# How to read a paper

General Structure of a paper:

- Abstract

- Introduction
  - *introduction of the general question to be addressed and literature context (many references)*
  - *relevance of topic*
  - *overview of paper structure*

- Observations / Data Presentation / Simulation Set-up
  - *Often technical details on the data collection (telescope set-up), data reduction (analysis techniques) or specifics of a theoretical experiment*

- Analysis / Methods
  - *Presentation of measurements inferred from the data / simulations*

# How to read a paper

General Structure of a paper:

- ■ Discussion / Results
  - – *Interpretation of results*
  - – *Comparison with other works Comparison with models / expectations Speculations*

- ■ Summary / Conclusions

- ■ References (with hyperlinks)

- ■ Acknowledgements

- ■ Appendix
  - – *Additional material (analysis description, plots) that would disturb the flow of the main paper text*

- ■ Online Material (tables, more figures etc.)

# How to read a paper

- demo

# Questions?

# How to give a good talk

# How to write a report

- [https://ui.adsabs.harvard.edu/abs/2022NatAs...6.1015C/abstract](https://ui.adsabs.harvard.edu/abs/2022NatAs...6.1015C/abstract)

- [https://ui.adsabs.harvard.edu/abs/2022NatAs...6.1021K/abstract](https://ui.adsabs.harvard.edu/abs/2022NatAs...6.1021K/abstract)

- Latex & overleaf

# Questions?

# HJAC – Tuesdays at 4pm
# Philosophenweg 12