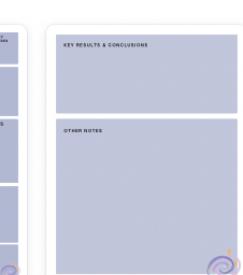
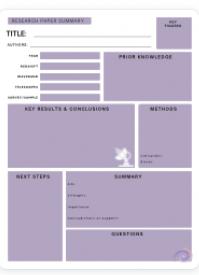
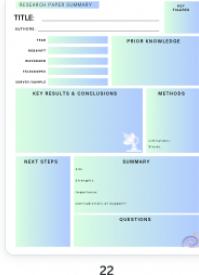
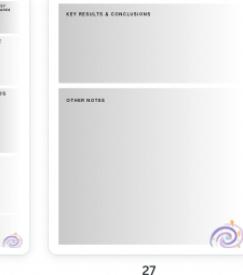


ASTRONOMY RESEARCH PAPER SUMMARY TEMPLATES

COLLECTION OF RESEARCH SUMMARY TEMPLATES IN VARIOUS COLORS TO HELP SYNTHESIZE, ORGANIZE, AND GUIDE THE READING OF TECHNICAL RESEARCH PAPERS. TWO EXAMPLES OF COMPLETED SUMMARIES ARE PROVIDED. SEE "ASTRONOMY PAPER SEMINAR PARTICIPATION GUIDE & READING WALKTHROUGH" FROM COOKE ET AL. 2020 FOR MORE ADVICE ON JOURNAL CLUBS AND PAPER READING. ([HTTPS://DOI.ORG/10.48550/ARXIV.2006.12566](https://doi.org/10.48550/ARXIV.2006.12566))

MADE BY ASHLEY LIEBER, ASHLEYLIEBER@KU.EDU
CANVA TEMPLATE FOUND AT: [HTTPS://TINYURL.COM/47UTFSTS](https://tinyurl.com/47utfsts)

					
4	5	6	7	8	9
					
10	11	12	13	14	15
					
16	17	18	19	20	21
					
22	23	24	25	26	27

RESEARCH PAPER SUMMARY

EXAMPLE

KEY FIGURES

TITLE: Can Molecular Ratios be used as Diagnostics of AGN and Starburst activity? The Case of NGC 1068.

AUTHORS: J. Butterworth, J. Holdship, S. Viti, and Santiago Garcia-Burillo

YEAR September 14, 2022

REDSHIFT $z = 0.004$

EMISSION HCN (1-0) and HCO+ lines

TELESCOPES ALMA, PdBI, and single dish observations

TARGET NGC 1068

PRIOR KNOWLEDGE

Keywords: Interstellar medium (ISM), molecules, galaxies; active - Seyfert - starburst - ISM - astrochemistry

- Molecular line ratios, such as HCN(1-0)/HCO+ (1-0) and HCN(4-3)/CS(7-6) are routinely used to identify AGN activity in galaxies. Such ratios are however hard to interpret as they are highly dependent on the physics and energetics of the gas and hence can seldom be used as a unique unambiguous diagnostic

KEY RESULTS & CONCLUSIONS

- They found that at high spatial resolution (< 50 pc) the HCN(4-3)/CS(2-1) is a reliable tracer of AGN activity. Finally we find that the variations in ratios are not a consequence of different densities or temperature but of different fractional abundances yielding to the important result that it is essential to consider the what chemical processes are at play when drawing conclusions from radiative transfer calculations.
 - Upon analysis at varying spatial scales previous proposed as well as a new molecular line ratio have been shown to have varying levels of consistency



METHODS

- Empirically examine previous ratios at different angular resolutions
- Use LTE and non-LTE analysis and Markov Chain Monte Carlos sampling to determine origin of the underlying differences of such ratios

MORE FINDINGS

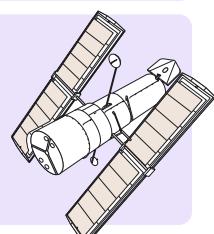
- We have also determined from investigation of radiative transfer modelling of our data that it is essential to consider the chemistry of the species when reaching conclusions from radiative transfer calculations.
- When observed at high spatial resolution, we propose a new ratio as a reliable tracer of AGN activity: the HCN(4-3)/CS(2-1).
- The origin of the differences in ratios and found that differences in gas densities and temperatures are not the cause of the differentiation

SUMMARY

- We use the composite galaxy NGC 1068 as a "laboratory", to investigate whether molecular line ratios between HCN, HCO+ and CS are useful tracers of AGN-dominated gas and determine the origin of the differences in such ratios across different types of gas. Such determination will allow a more rigorous use of such ratios.
- We have also determined from investigation of radiative transfer modelling of our data that it is essential to consider the chemistry of the species when reaching conclusions from radiative transfer calculations.

QUESTIONS

Now that they've determined the origin of the differences in such ratios, what would be the next steps in their research? What kinds of questions can now be answered and asked?



TITLE: Tentative Evidence for Water Vapor in the Atmosphere of the Neptune-sized Exoplanet HD 106315c**AUTHORS:** Kreidberg, Laura; Moliere, Paul; Crossfield, Ian J. M.; Thorngren, Daniel**KEY FIGURES**

Fig. 5 Transit light curves; Fig 7: Transmission spectrum

YEAR October 2022**OBSERVATIONS** Transmission spectrum**WAVELENGTH** Optical to infrared**TELESCOPES** HST, K2, and Spitzer**TARGET** Exoplanet HD 106315c**PRIOR KNOWLEDGE**

Keywords: Exoplanet atmospheres, Water vapor, hot neptunes, exoplanets, atmospheric clouds

- For this work the spectral evidence and analysis is key, so understanding the significance of spectrum in the case of exoplanets and potential water presence is critical

KEY RESULTS & CONCLUSIONS

- The spectrum shows tentative evidence for a water absorption feature in the 1.1-1.7 μm wavelength range with a small amplitude of 30 ppm (corresponding to just 0.8 ± 0.04 atmospheric scale heights).
- The presence of water vapor is tentatively favored with a Bayes factor of 1.7-2.6 (depending on prior assumptions)
 - The spectrum is most consistent with either an enhanced metallicity or high altitude condensates, or both. The spectrum is fit well by models with moderate cloud lofting or haze formation efficiency over a wide range of metallicities (1-100 \times solar)

**METHODS**

- Utilized an atmospheric retrieval analysis to analyze potential water vapor presence
- Additionally modeling was done to combine the constraints on the envelope composition with an interior structure model and estimate core mass fraction

NEXT STEPS..

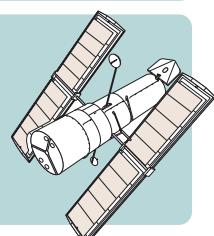
- A further demographic study of water absorption in sub-Neptunes will be explored in a followup paper
- While the current transmission spectrum presented here does not constrain the atmospheric composition well enough to make possible a meaningful comparison with Neptune, these caveats are important to bear in mind for future observations for HD 106315c and other small planets.

SUMMARY

- With a bulk composition reminiscent of that of Neptune and an orbital distance of 0.15 au, HD 106315c hints that planets may form out of broadly similar material and arrive at vastly different orbits later in their evolution
- The spectral features are consistent with that of other Sub-Neptunes
- The tentative water detection for HD 106315c is consistent with a wide range of abundances (3×10^{-4} - $290 \times$ solar at 1σ confidence)
- This is a somewhat surprising finding, because there are many factors (noted above) that affect the observed spectral feature amplitude for planets in this population.

QUESTIONS

- Look into the differences in what is considered a Neptune vs. Sub-neptune. What are the classical characteristics?
- What does the presence of water mean for this? Is it purely categorical?



RESEARCH PAPER SUMMARY

KEY FIGURES

TITLE: _____

AUTHORS: _____

YEAR

REDSHIFT

WAVEBAND

TELESCOPES

SURVEY/SAMPLE

PRIOR KNOWLEDGE

KEY RESULTS & CONCLUSIONS

METHODS



Limitations:

Biases:

NEXT STEPS

SUMMARY

Aim:

Strengths:

Importance:

Contradictions or Support?

QUESTIONS



KEY RESULTS & CONCLUSIONS

OTHER NOTES



RESEARCH PAPER SUMMARY

KEY FIGURES

TITLE: _____

AUTHORS: _____

YEAR

REDSHIFT

WAVEBAND

TELESCOPES

SURVEY/SAMPLE

PRIOR KNOWLEDGE

KEY RESULTS & CONCLUSIONS

METHODS



Limitations:

Biases:

NEXT STEPS

SUMMARY

Aim:

Strengths:

Importance:

Contradictions or Support?

QUESTIONS



KEY RESULTS & CONCLUSIONS

OTHER NOTES



RESEARCH PAPER SUMMARY

KEY FIGURES

TITLE: _____

AUTHORS: _____

YEAR _____

REDSHIFT _____

WAVEBAND _____

TELESCOPES _____

SURVEY/SAMPLE _____

PRIOR KNOWLEDGE

KEY RESULTS & CONCLUSIONS

METHODS



Limitations:

Biases:

NEXT STEPS

Aim:

Strengths:

Importance:

Contradictions or Support?

SUMMARY

QUESTIONS



KEY RESULTS & CONCLUSIONS

OTHER NOTES



RESEARCH PAPER SUMMARY

KEY FIGURES

TITLE: _____

AUTHORS: _____

YEAR

REDSHIFT

WAVEBAND

TELESCOPES

SURVEY/SAMPLE

PRIOR KNOWLEDGE

KEY RESULTS & CONCLUSIONS

METHODS



Limitations:

Biases:

NEXT STEPS

SUMMARY

Aim:

Strengths:

Importance:

Contradictions or Support?

QUESTIONS



KEY RESULTS & CONCLUSIONS

OTHER NOTES



RESEARCH PAPER SUMMARY

KEY FIGURES

TITLE: _____

AUTHORS: _____

YEAR

REDSHIFT

WAVEBAND

TELESCOPES

SURVEY/SAMPLE

PRIOR KNOWLEDGE

KEY RESULTS & CONCLUSIONS



METHODS

Limitations:

Biases:

NEXT STEPS

SUMMARY

Aim:

Strengths:

Importance:

Contradictions or Support?

QUESTIONS



KEY RESULTS & CONCLUSIONS

OTHER NOTES



RESEARCH PAPER SUMMARY

KEY FIGURES

TITLE: _____

AUTHORS: _____

YEAR

REDSHIFT

WAVEBAND

TELESCOPES

SURVEY/SAMPLE

PRIOR KNOWLEDGE

KEY RESULTS & CONCLUSIONS



METHODS

Limitations:

Biases:

NEXT STEPS

SUMMARY

Aim:

Strengths:

Importance:

Contradictions or Support?

QUESTIONS



KEY RESULTS & CONCLUSIONS

OTHER NOTES



RESEARCH PAPER SUMMARY

KEY FIGURES

TITLE: _____

AUTHORS: _____

YEAR

REDSHIFT

WAVEBAND

TELESCOPES

SURVEY/SAMPLE

PRIOR KNOWLEDGE

KEY RESULTS & CONCLUSIONS

METHODS



Limitations:

Biases:

NEXT STEPS

SUMMARY

Aim:

Strengths:

Importance:

Contradictions or Support?

QUESTIONS



KEY RESULTS & CONCLUSIONS

OTHER NOTES



RESEARCH PAPER SUMMARY

KEY FIGURES

TITLE: _____

AUTHORS: _____

YEAR

REDSHIFT

WAVEBAND

TELESCOPES

SURVEY/SAMPLE

PRIOR KNOWLEDGE

KEY RESULTS & CONCLUSIONS

METHODS



Limitations:

Biases:

NEXT STEPS

SUMMARY

Aim:

Strengths:

Importance:

Contradictions or Support?

QUESTIONS



KEY RESULTS & CONCLUSIONS

OTHER NOTES



RESEARCH PAPER SUMMARY

KEY FIGURES

TITLE: _____

AUTHORS: _____

YEAR

REDSHIFT

WAVEBAND

TELESCOPES

SURVEY/SAMPLE

PRIOR KNOWLEDGE

KEY RESULTS & CONCLUSIONS

METHODS



Limitations:

Biases:

NEXT STEPS

SUMMARY

Aim:

Strengths:

Importance:

Contradictions or Support?

QUESTIONS



KEY RESULTS & CONCLUSIONS

OTHER NOTES



RESEARCH PAPER SUMMARY

KEY FIGURES

TITLE: _____

AUTHORS: _____

YEAR

REDSHIFT

WAVEBAND

TELESCOPES

SURVEY/SAMPLE

PRIOR KNOWLEDGE

KEY RESULTS & CONCLUSIONS

METHODS



Limitations:

Biases:

NEXT STEPS

SUMMARY

Aim:

Strengths:

Importance:

Contradictions or Support?

QUESTIONS



KEY RESULTS & CONCLUSIONS

OTHER NOTES



RESEARCH PAPER SUMMARY

KEY FIGURES

TITLE: _____

AUTHORS: _____

YEAR

REDSHIFT

WAVEBAND

TELESCOPES

SURVEY/SAMPLE

PRIOR KNOWLEDGE

KEY RESULTS & CONCLUSIONS

METHODS



Limitations:

Biases:

NEXT STEPS

SUMMARY

Aim:

Strengths:

Importance:

Contradictions or Support?

QUESTIONS



KEY RESULTS & CONCLUSIONS

OTHER NOTES



TITLE: _____**AUTHORS:** _____**YEAR****REDSHIFT****WAVEBAND****TELESCOPES****SURVEY/SAMPLE****PRIOR KNOWLEDGE****KEY RESULTS & CONCLUSIONS****METHODS**

Limitations:

Biases:

NEXT STEPS**SUMMARY**

Aim:

Strengths:

Importance:

Contradictions or Support?

QUESTIONS

KEY RESULTS & CONCLUSIONS

OTHER NOTES

