# D20.3 Structure of Arguments in Science: Modelling Kepler's "Astronomia nova"

*Prof. Gerd Graßhoff (HU Berlin, MPIWG Berlin)*
*Mohammad Yeghaneh Abkenar (HU Berlin)*

## Scientific Publications, text corpora

- **Kepler's "Astronomia nova" Corpus**
  - Revolutionary new theory of planetary motion
  - Purely geometrical epicyclic models by physical interpretations
  → Aim: *Computational model of Kepler's argumentation*
- **Exoplanet Publication Corpus [1]**
  - Scientific articles on recent research on exoplanets 1990-2020
  → Aim: *Computational model to extract arguments*
- **Corona Virus Publication Corpus**
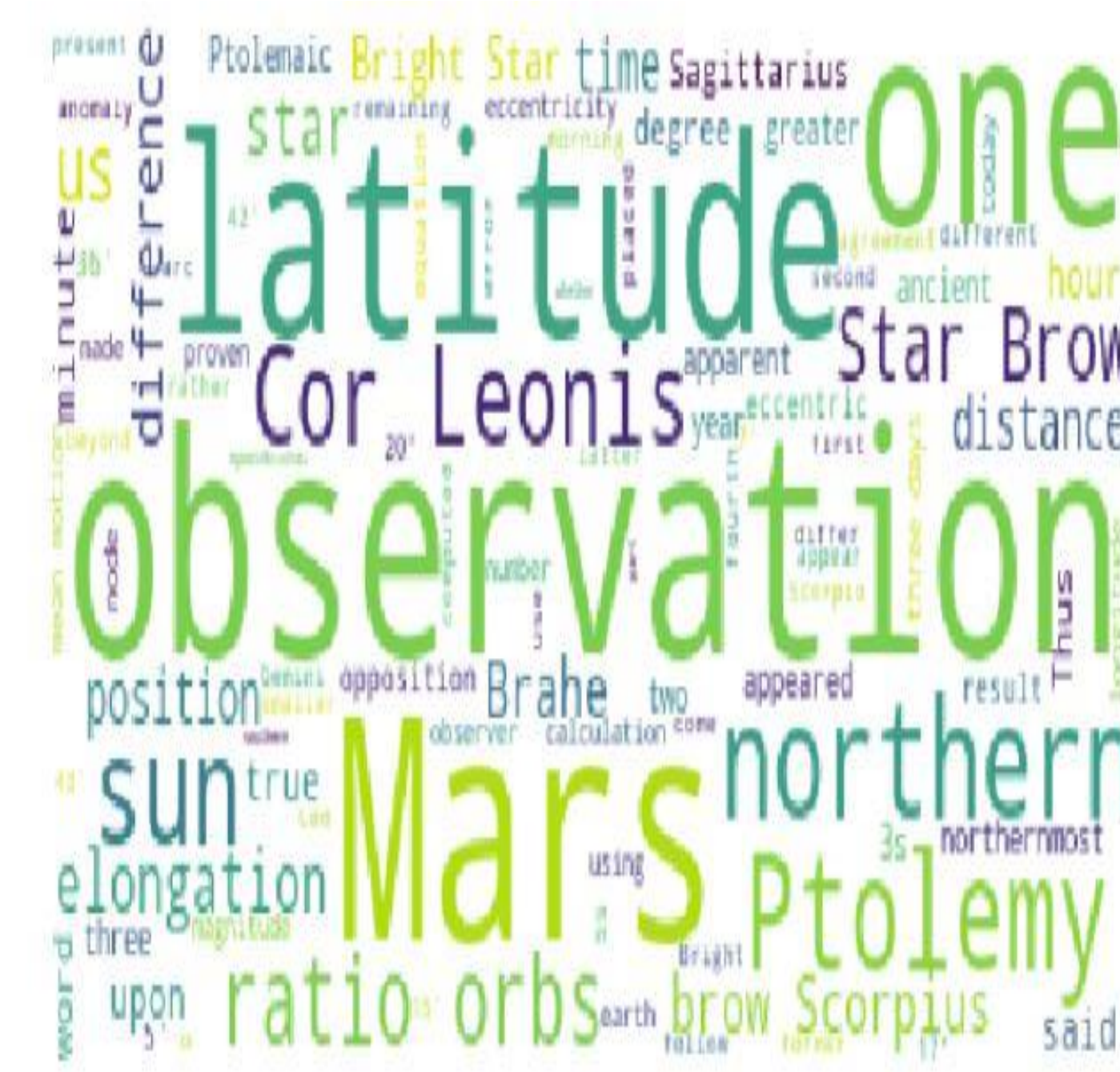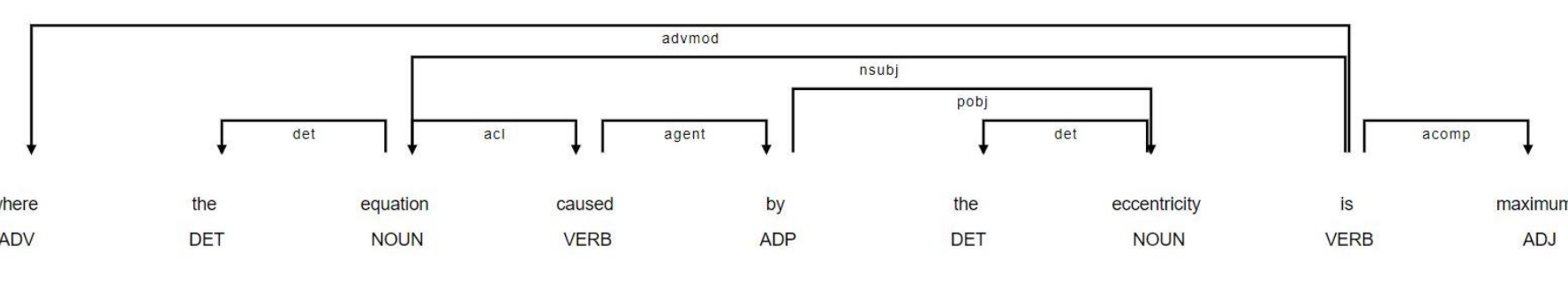  - The corpus analysis modelling understanding of COVID-19

## Astronomia nova

*The corpora are represented in structural trees representing their textual division.*
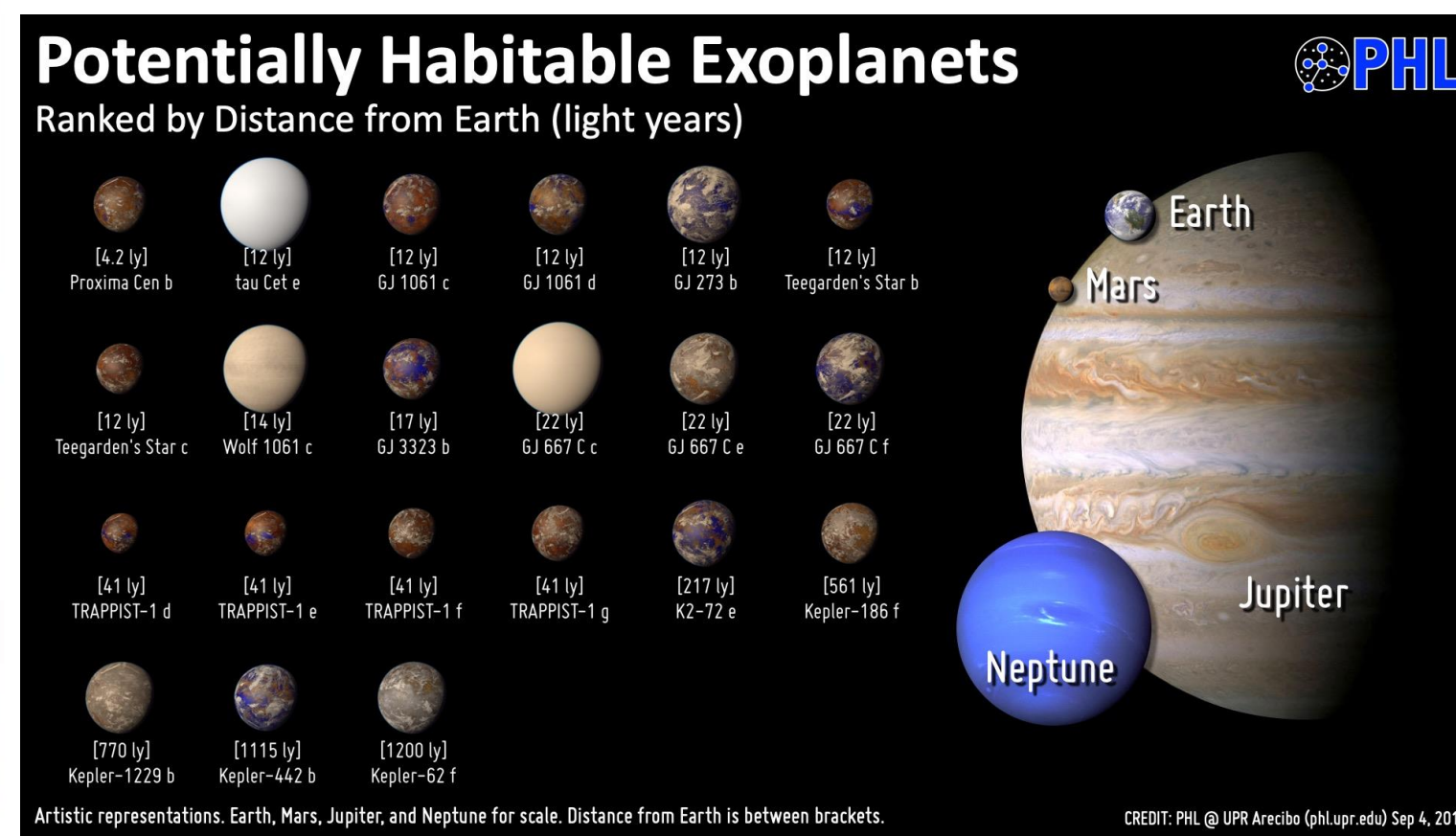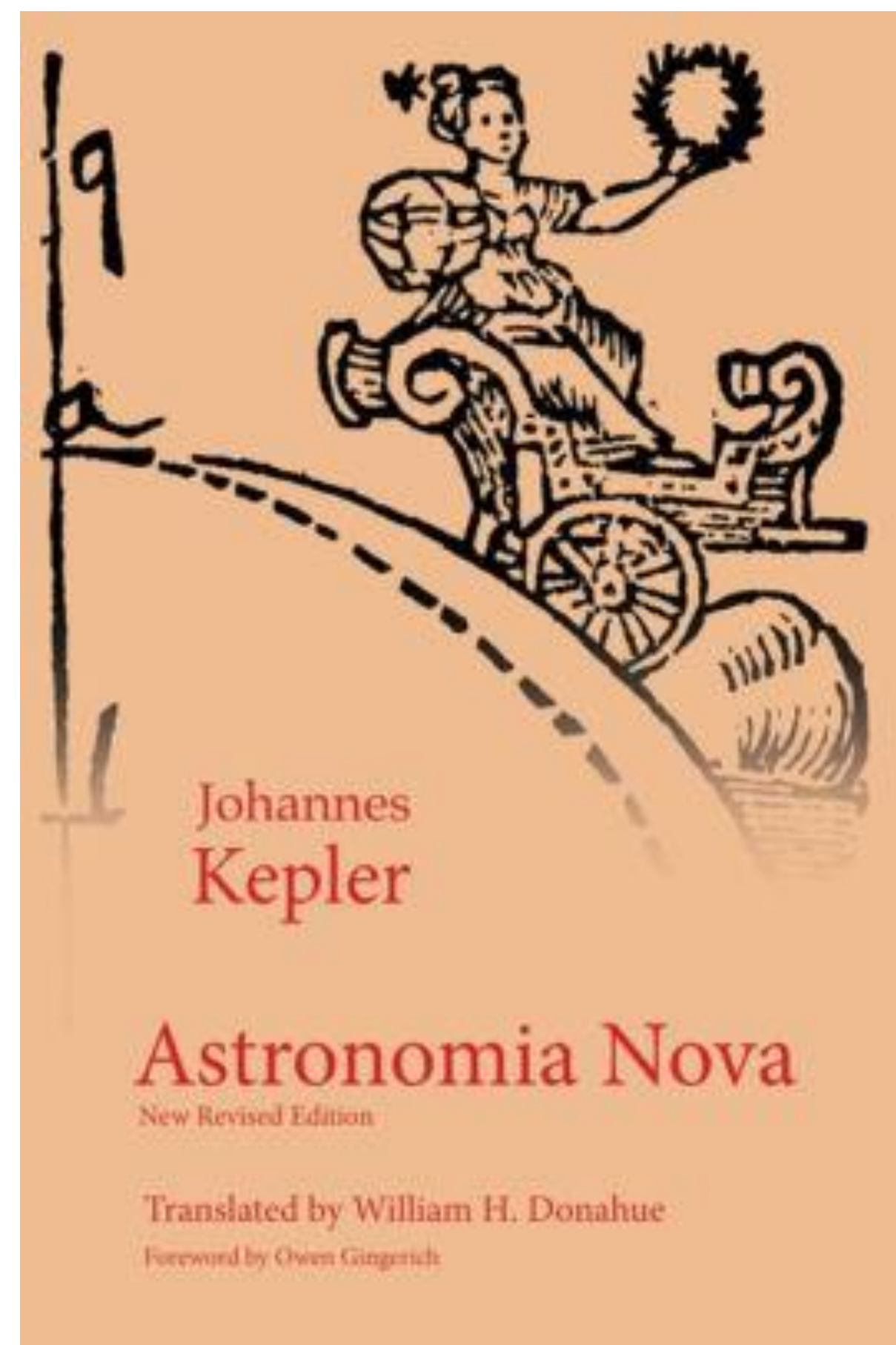1) *Parts, chapters, paragraphs, sentences, tables, diagrams*
2) *Sentence structure analysed with Spacy*

   a) Customized entities

   b) Dependency parsing



Johannes Kepler
Astronomia Nova
New Revised Edition
Translated by William H. Donahue
Foreword by Owen Gingerich

Potentially Habitable Exoplanets
Ranked by Distance from Earth (light years)

## Customized named entity recognition (NER) [2]

*Key Idea.* Hybrid approach; pattern(rule) based & deep learning approach to provide NER model using spaCy.



## Explicit Observation Extraction [2]

*Key Idea.* Extract Observations from the corpus by customized NER model.



## Model between layers of textual, linguistic and semantic structures

- *Textual structures are the ground layer interpreted by argument modeling*
- *Linguistic parsing extracts tokens, entities, dependency graphs*
- *Semantic tree structure contain semantic elements, statements and their relations*

- *Argument modeling extracts logical, causal, geometrical, **scientific reasoning**.*

## References

[1] Graßhoff, Gerd; Bier, Sabrina (2019): Database of abstracts in publications on exoplanets from the NASA archive. Zenodo. Dataset.
https://doi.org/10.5281/zenodo.3269732
[2] Yeghaneh, Mohammad; https://github.com/myeghaneh

[3] Ribeiro, M. T., Singh, S., & Guestrin, C. (2016, August). " Why should i trust you?" Explaining the predictions of any classifier. In *Proceedings of the 22nd ACM SIGKDD international conference on knowledge discovery and data mining* (pp. 1135-1144).