Scientific Writing in Astro Lecture #3

Dorottya Szécsi

Class/Book on Scientific Writing...

- 1 Some introduction

- 2 Reading and the logical structure of articles

- 3 Abstracts

- 4 Before you start writing: planning, brainstorming

- 5 The body of an article

- 6 Figures, tables, equations.

- 7 Language and Style 1: Sentences to paragraphs

- 8 Language and Style 2: Verbs and punctuation

- 9 Language and Style 3: Style, common mistakes

- 10 Information sources, citations, plagiarism and ethics.

- 11 Criticism and peer review

- 12 Tools for writing, other topics, summary

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Abstract

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- limits! 200-250 words, not more.

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  - thesis abstracts may be longer

How to construct a *Nature* summary paragraph

Annotated example taken from *Nature* 435, 114–118 (5 May 2005).

One or two sentences providing a **basic introduction** to the field, comprehensible to a scientist in any discipline.

Two to three sentences of **more detailed background**, comprehensible to scientists in related disciplines.

One sentence clearly stating the **general problem** being addressed by this particular study.

One sentence summarizing the main result (with the words "**here we show**" or their equivalent).

Two or three sentences explaining what the **main result** reveals in direct comparison to what was thought to be the case previously, or how the main result adds to previous knowledge.

One or two sentences to put the results into a more **general context**.

Two or three sentences to provide a **broader perspective**, readily comprehensible to a scientist in any discipline, may be included in the first paragraph if the editor considers that the accessibility of the paper is significantly enhanced by their inclusion. Under these circumstances, the length of the paragraph can be up to 300 words. (This example is 190 words without the final section, and 250 words with it).

During cell division, mitotic spindles are assembled by microtubule-based motor proteins[1,2]. The bipolar organization of spindles is essential for proper segregation of chromosomes, and requires plus-end-directed homotetrameric motor proteins of the widely conserved kinesin-5 (BimC) family[3]. Hypotheses for bipolar spindle formation include the 'push–pull mitotic muscle' model, in which kinesin-5 and opposing motor proteins act between overlapping microtubules[2,4,5]. However, the precise roles of kinesin-5 during this process are unknown. Here we show that the vertebrate kinesin-5 Eg5 drives the sliding of microtubules depending on their relative orientation. We found in controlled *in vitro* assays that Eg5 has the remarkable capability of simultaneously moving at ~20 nm s^{-1} towards the plus-ends of each of the two microtubules it crosslinks. For anti-parallel microtubules, this results in relative sliding at ~40 nm s^{-1}, comparable to spindle pole separation rates *in vivo*[6]. Furthermore, we found that Eg5 can tether microtubule plus-ends, suggesting an additional microtubule-binding mode for Eg5. Our results demonstrate how members of the kinesin-5 family are likely to function in mitosis, pushing apart interpolar microtubules as well as recruiting microtubules into bundles that are subsequently polarized by relative sliding. We anticipate our assay to be a starting point for more sophisticated *in vitro* models of mitotic spindles. For example, the individual and combined action of multiple mitotic motors could be tested, including minus-end-directed motors opposing Eg5 motility. Furthermore, Eg5 inhibition is a major target of anti-cancer drug development, and a well-defined and quantitative assay for motor function will be relevant for such developments.

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AVOID:
abbreviations
references
jargon
convoluted sentences
figures
tables

A&A structured abstract

- \abstract{}{}{}{}{}

- 5 {} tokens are mandatory:

```
\abstract   {} %Context.
            {} %Aims.
            {} %Method.
            {} %Results.
            {} %Conclusions.
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Supergiants and their shells in young globular clusters
(Szécsi+18, A&A)

ABSTRACT

Context. Anomalous surface abundances are observed in a fraction of the low-mass stars of Galactic globular clusters, that may originate from hot-hydrogen-burning products ejected by a previous generation of massive stars.

Aims. We aim to present and investigate a scenario in which the second generation of polluted low-mass stars can form in shells around cool supergiant stars within a young globular cluster.

Methods. Simulations of low-metallicity massive stars ($M_i \sim 150-600\ M_\odot$) show that both core-hydrogen-burning cool supergiants and hot ionizing stellar sources are expected to be present simultaneously in young globular clusters. Under these conditions, photoionization-confined shells form around the supergiants. We have simulated such a shell, investigated its stability and analysed its composition.

Results. We find that the shell is gravitationally unstable on a timescale that is shorter than the lifetime of the supergiant, and the Bonnor-Ebert mass of the overdense regions is low enough to allow star formation. Since the low-mass stellar generation formed in this shell is made up of the material lost from the supergiant, its composition necessarily reflects the composition of the supergiant wind. We show that the wind contains hot-hydrogen-burning products, and that the shell-stars therefore have very similar abundance anomalies that are observed in the second generation stars of globular clusters.

Conclusions. Star-forming shells around cool supergiants could form the second generation of low-mass stars in Galactic globular clusters. Even without forming a photoionizaton-confined shell, the cool supergiant stars predicted at low-metallicity could contribute to the pollution of the interstellar medium of the cluster from which the second generation was born. Thus, the cool supergiant stars should be regarded as important contributors to the evolution of globular clusters.

Key words. Stars: supergiants – Globular clusters: general – Circumstellar matter – Stars: formation – Stars: abundances – Radiative transfer

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Citations & references

IF I HAVE SEEN FURTHER,
IT IS BY STANDING
**ON THE SHOULDERS
OF GIANTS.**

- ISAAC NEWTON

WILTGREN.COM

Citations & references

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  - \bibliography{Yourfile} %your references in Yourfile.bib

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Editing & finishing up
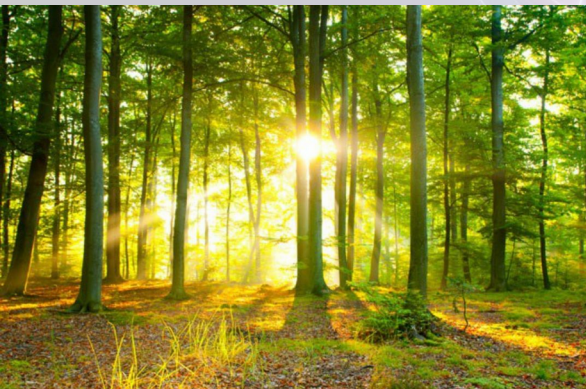
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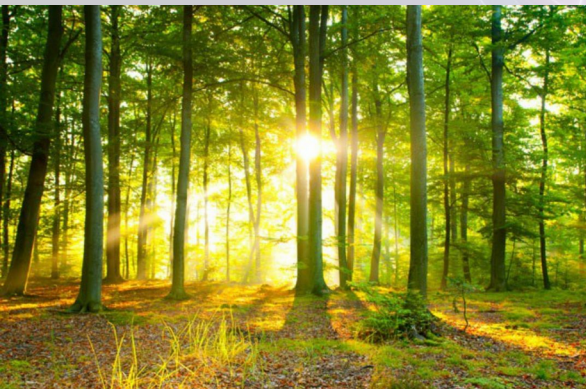
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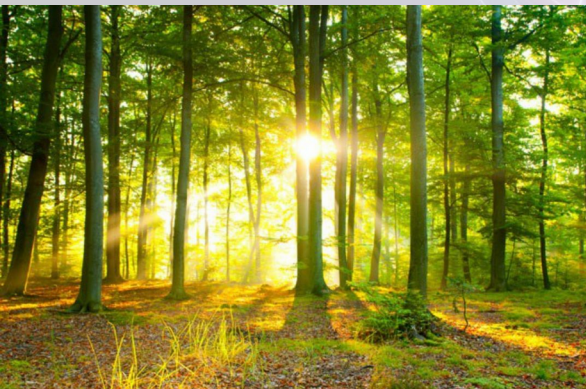   – making revisions

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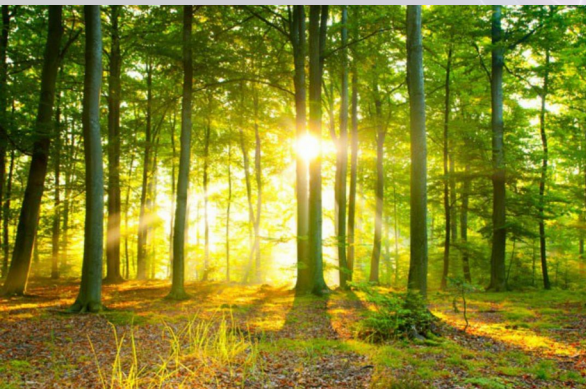   - getting feedback from others (co-authors)
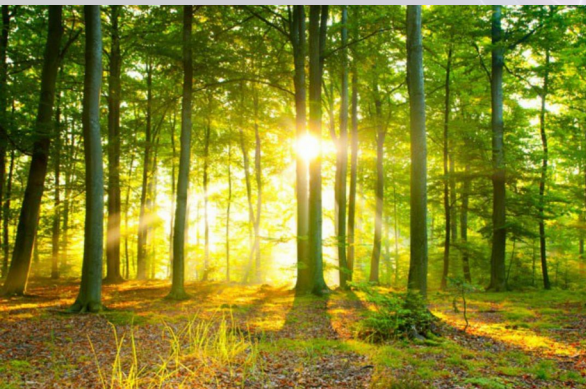
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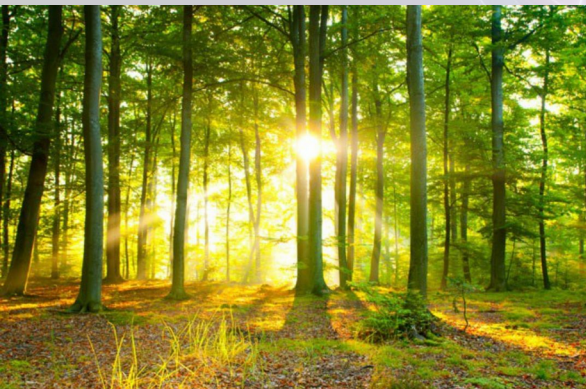   - getting feedback from others (co-authors)
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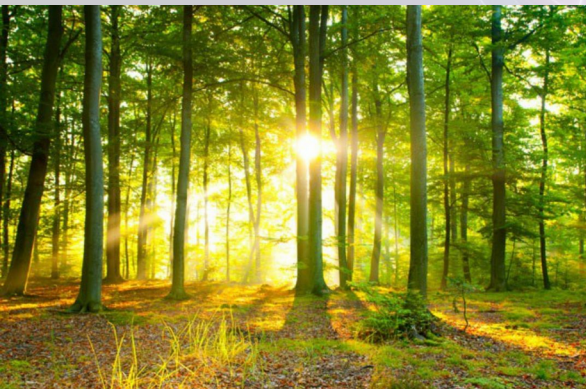 - formatting & syntax

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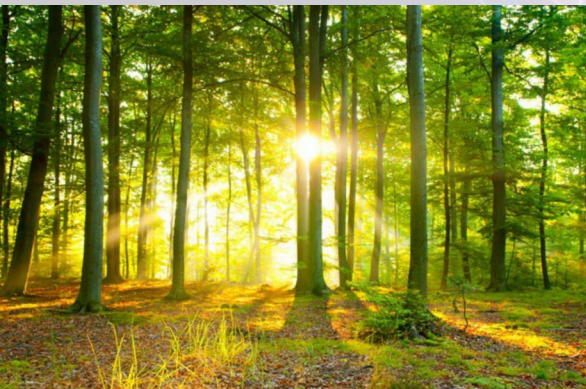- However: *do celebrate* the first draft!! ;)

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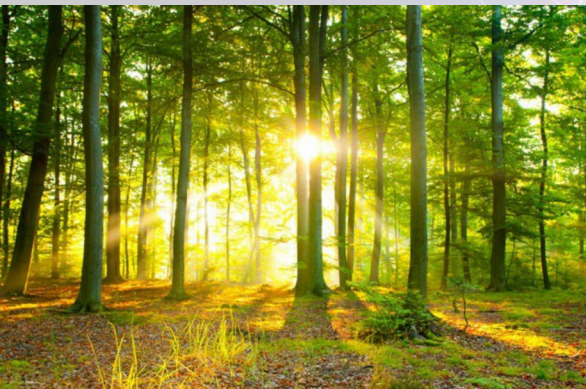- But anticipate that editing is as difficult as writing… ¯_(ツ)_/¯

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 - it takes many days to write → losing track is normal

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3 tasks:

– *concision*: cut what's not needed
...no decorations on your pine-tree ;)

– *precision*: clarify everything
...logics of the arguments

– *revision*: sharpen transitions
…chain rule, "therefore" etc.
...within sentences & paragraphs!
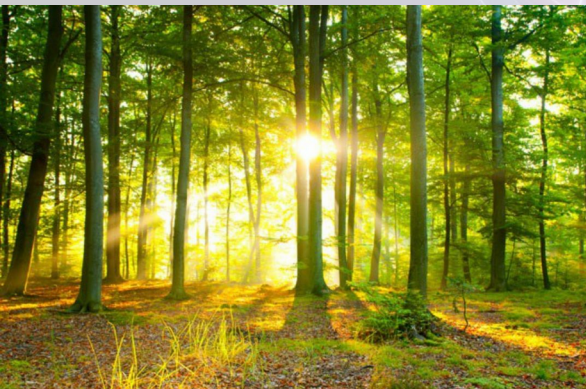
Paragraphs

- One theme!
  - focused
  - coherent

- Topic sentence (1st sentence)
  - defines the theme
  - Tip: maybe write only 1st sentences first?
  - connects previous info to new info

- Stress sentence (last sentence)
  - new information to be emphasized

Coherence

1) by enumeration

2) by transition (...)

3) by repetition

This is because (1) massive stars rotate fast, and (2) they experience mass loss.

Examples are (i) supernovae, (ii) gamma-ray bursts and (iii) gravitational waves.

Listing the possible outcomes (?):
- ► *expansion*
- ► *re-bounce*
- ► *accelerated expansion*

the "chain-rule"

Coherence by repetition: ''chain-rule''

The star's iron core **collapses** and falls in due to **gravity**. One may recall that this is how the usual textbook-explanation of a (core-**collapse**) supernova explosion continues (Fryer 2004): the iron core gets denser and denser, and eventually a **proto neutron star (NS) forms** in the middle. The material that is still falling in suddenly **bounces** back from the surface of the **newly formed proto-NS**. The outward **bouncing** gives rise to a shock-wave which may reach the surface and produce an **emission** of photons. This **emission** is what we may observe as a supernova lightcurve. If the iron core was more massive than ~20 Msun, its self-**gravity** will very soon overcome the proto-NS's internal pressure, creating a compact object with such a strong **gravitational** field that nothing, not even particles and electromagnetic radiation, can escape from it. A black hole is formed.

Coherence by transition

- **Sequence**

  again, and, besides, then, further, **furthermore**, next, moreover, in addition, first, second, third, etc.; (a), (b), (c), etc.; 1), 2), 3), etc.; following this, subsequently, to enumerate, also, another, last, plus

- **Comparison and contrast**

  at the same time, on the contrary, in contrast, **nevertheless**, notwithstanding, nonetheless, conversely, like, unlike, even so, in the same way, as, unless, whether, though, even though, regardless, irrespective, otherwise, in comparison to, even when, to the contrary, but, or, nor, yet, inasmuch, contrary to, comparing, alternatively, rather, despite, ironically

- **Examples**

  for example, for instance, in the case of, in general, especially, if, specifically, **in particular**, generally, on this occasion, in this situation, to illustrate, to demonstrate, as an illustration, as a demonstration, unless, such as, provided that, once again, another example, a further example, a further complication, in such cases, in this way, in some of these cases, for these reasons, one way, another way, as discussed, using, particularly, that is, more specifically, except

- **Time**

  while, since, simultaneously, presently, meanwhile, thereafter, thereupon, afterwards, at the same time, next, sometimes, in the meantime, eventually, **following this**, later, usually, occasionally, concurrently, preceding this, as, presently, at the time of this writing, often, rarely, throughout, by, at, during, continuing

- **Cause and effect**

  therefore, thus, consequently, as a consequence, for this reason, hence, accordingly, because, due to, in spite of, despite

- **Emphasis**

  surprisingly, **indeed**, interestingly, curiously, in fact, of course, naturally, evidently, certainly, clearly, obviously, apparently, fortunately, especially, significantly, perhaps, from my perspective, if possible, if so, basically, in reality, essentially

- **Concluding**

  finally, therefore, in summary, to conclude, in conclusion, **to summarize**, as I have shown, hence, thus, in other words, as said earlier, in any case, as a result, at least, as mentioned above, as said previously, thereby, in the present article, simply put

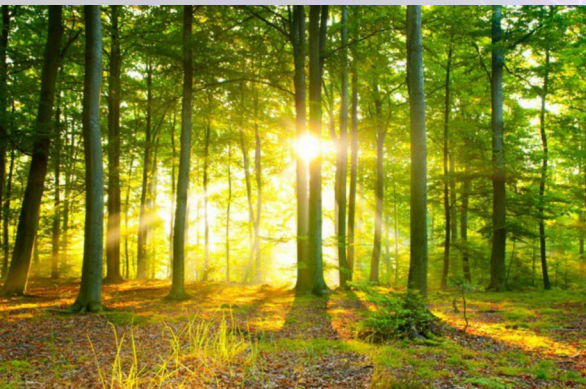# Length of paragraphs?

- 4-8 sentence

- shorter: emphasis

- longer: split it up! :)

Editing & finishing up

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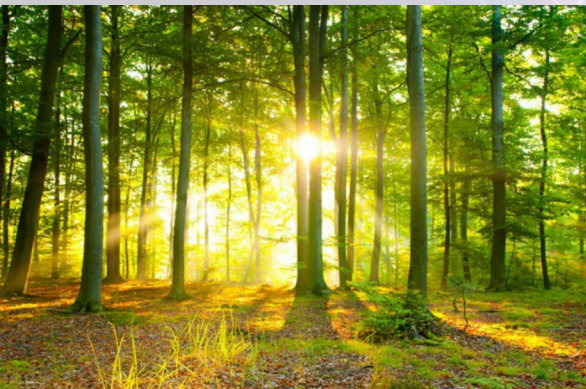 - formatting & s
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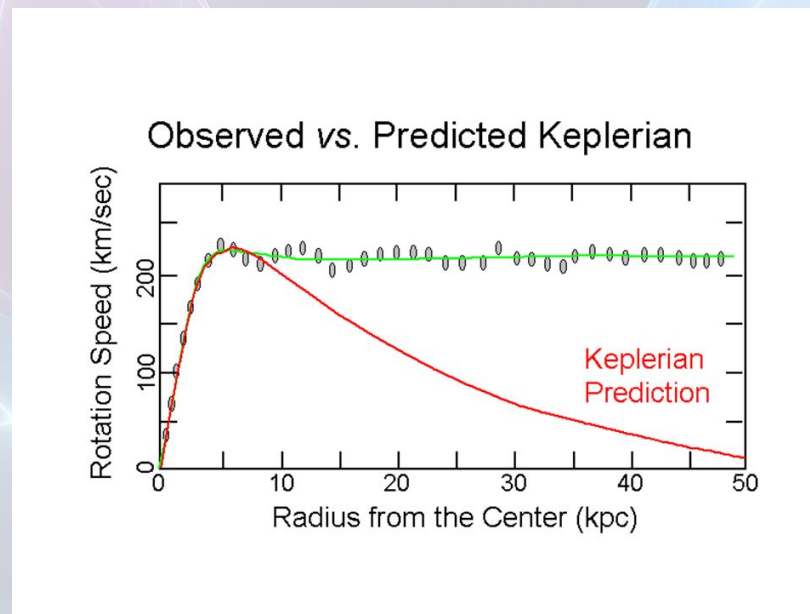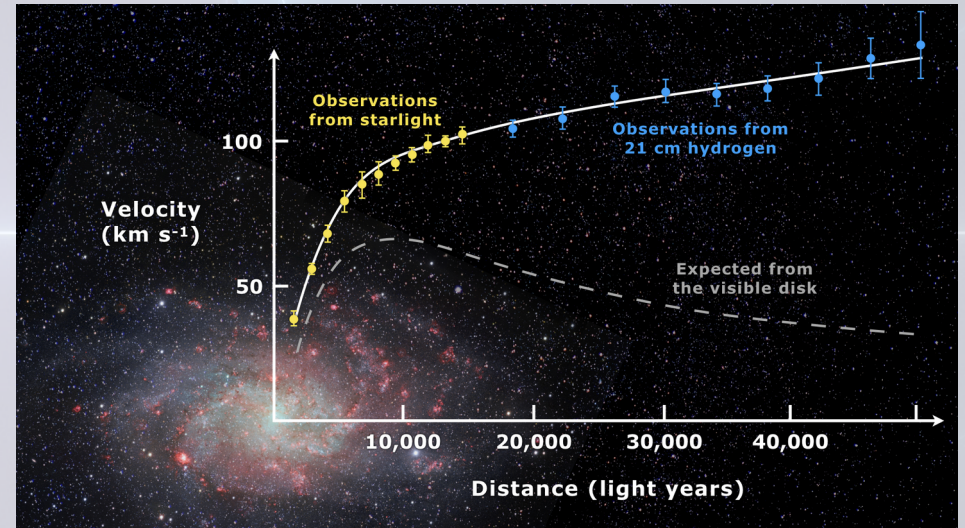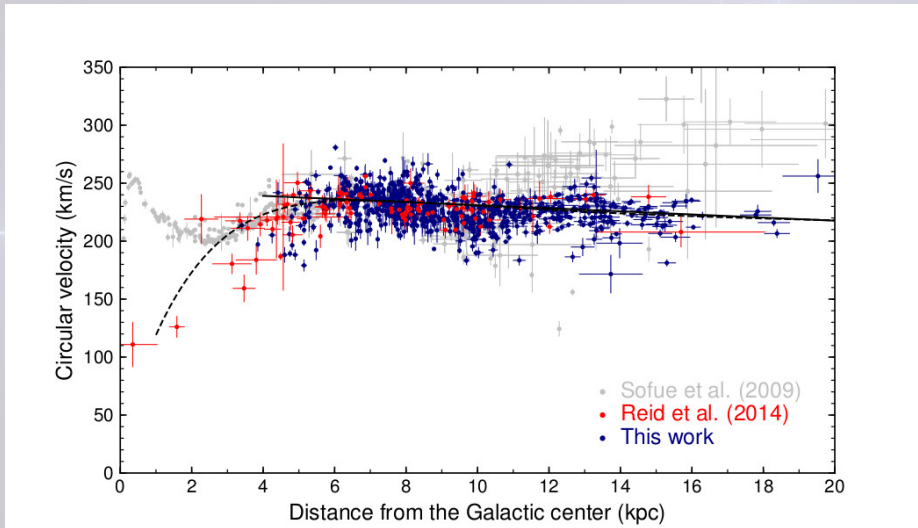*asks:*

what's not needed
your pine-tree ;)

clarify everything
of the arguments

– *revision*: sharpen transitions
…chain rule, "therefore" etc.
…within sentences & paragraphs!

Let me prepare you
for the future…

Exercise: write an abstract!

```
\abstract  {} %Context.
           {} %Aims.
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           {} %Conclusions.
```


Circular velocity (km/s) vs. Distance from the Galactic center (kpc). Legend: Sofue et al. (2009), Reid et al. (2014), This work.

Velocity (km s⁻¹) vs. Distance (light years). Observations from starlight; Observations from 21 cm hydrogen; Expected from the visible disk.

Observed vs. Predicted Keplerian. Rotation Speed (km/sec) vs. Radius from the Center (kpc). Keplerian Prediction.

Homework

- create a 3-slide presentation on a simple astro-related topic

  - your research overview?

  - a lab project?

  - a paper you recently read? press release?

- ***it should be as eye-catching as possible.***

    - but stay professional and elegant