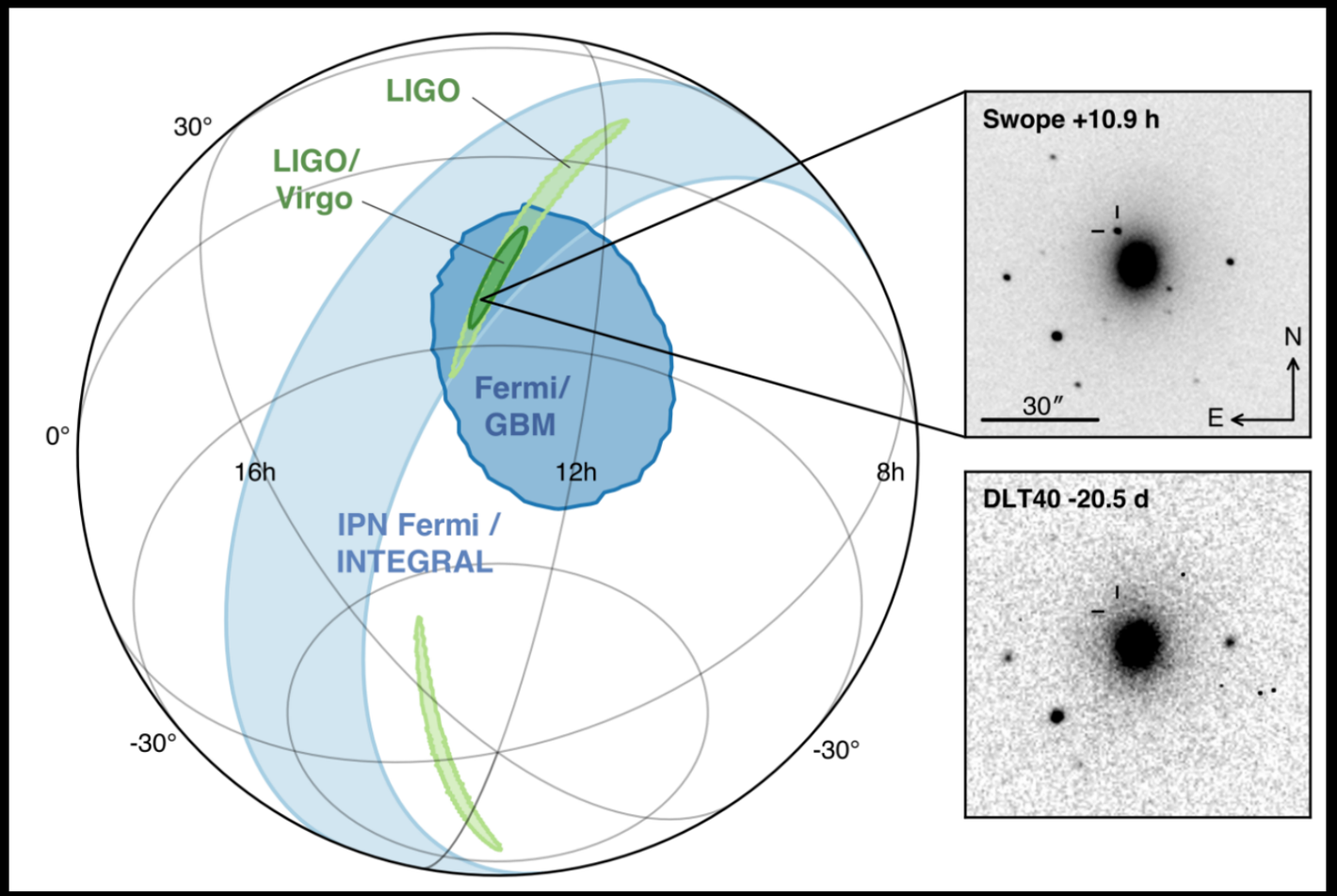
How to make effective plots

Figures as tools to convey messages



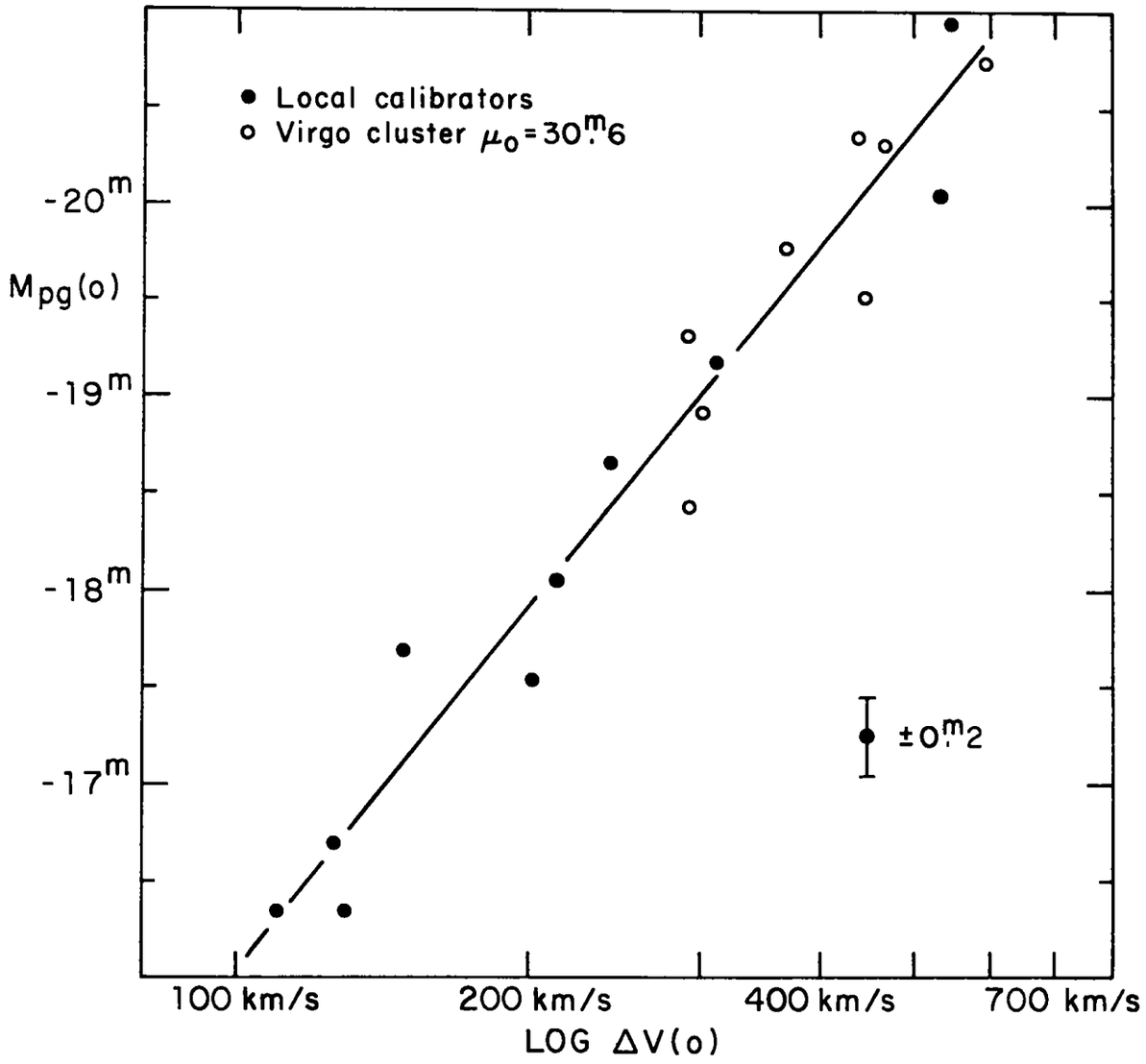
Abbott et al. 2017

Brendan Bowler

UT Austin — GSPS — Nov 10, 2017

Activity — Discuss the following questions with your neighbor:

- What is the **message** in these figures?
- What could be **improved** to better convey that message?
- Do you know which papers these are from?



Tully & Fisher 1977

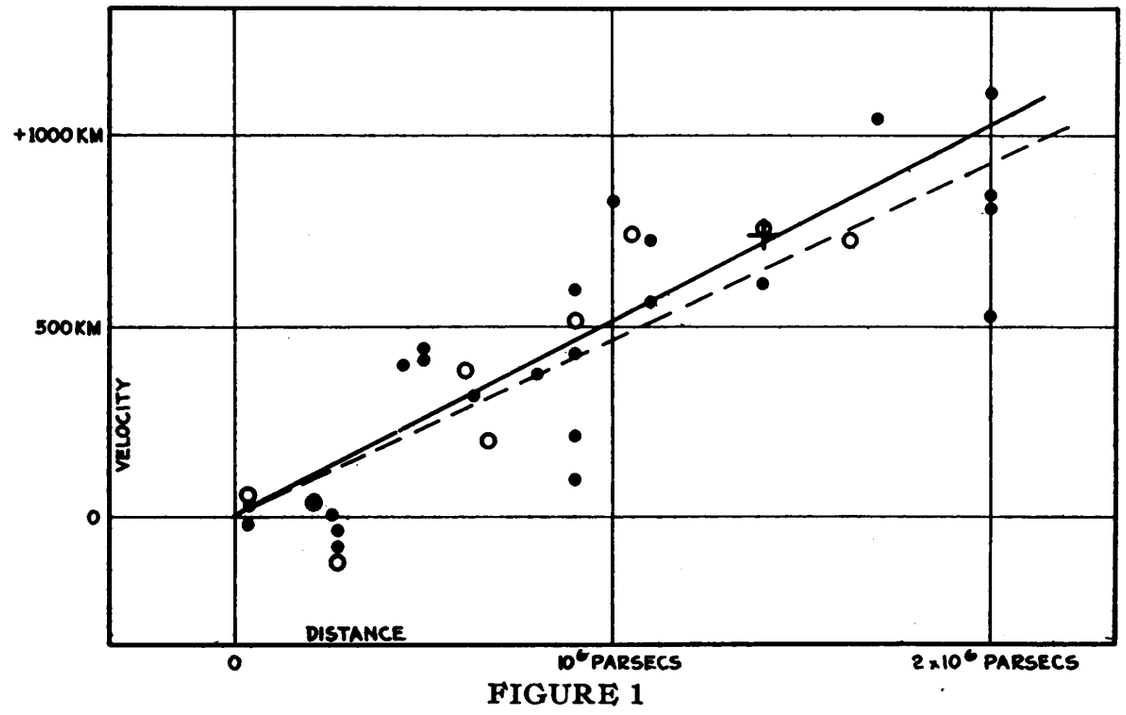
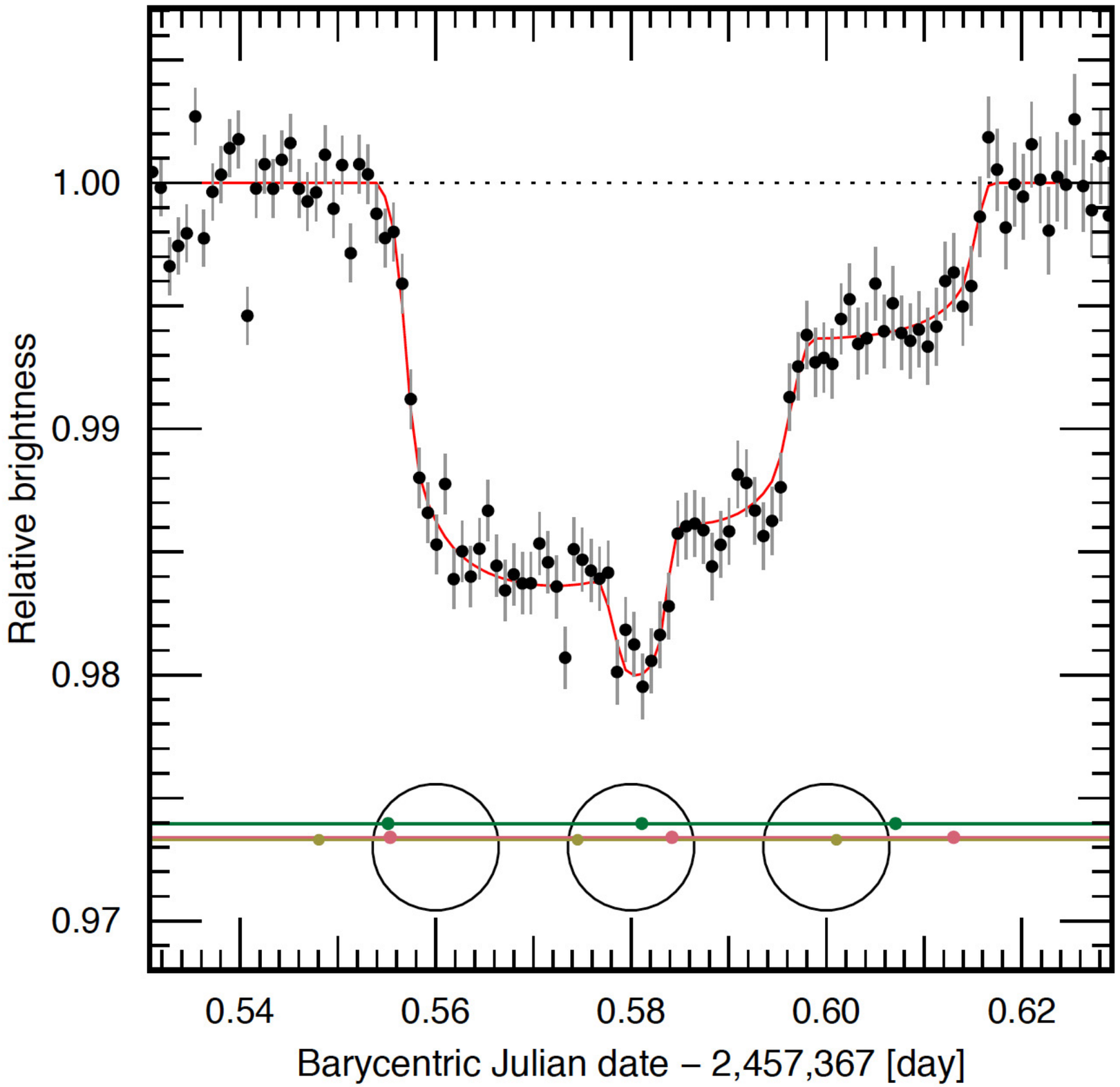


FIGURE 1

Hubble1929



Gillon et al. 2017, Nature

Some simple rules for creating impactful figures

Know your audience

- Who is the figure **intended** for?
- Figures are **interfaces** between data and humans; know the audience you are conveying the data to.
- Graphical design should be **informed by this intent.**

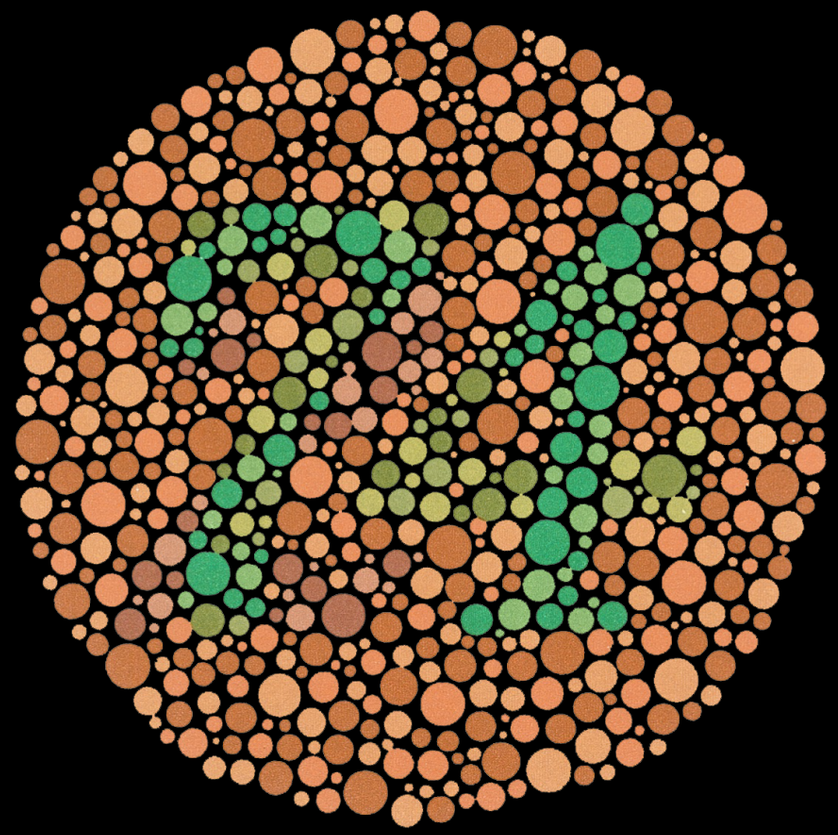
Identify your message

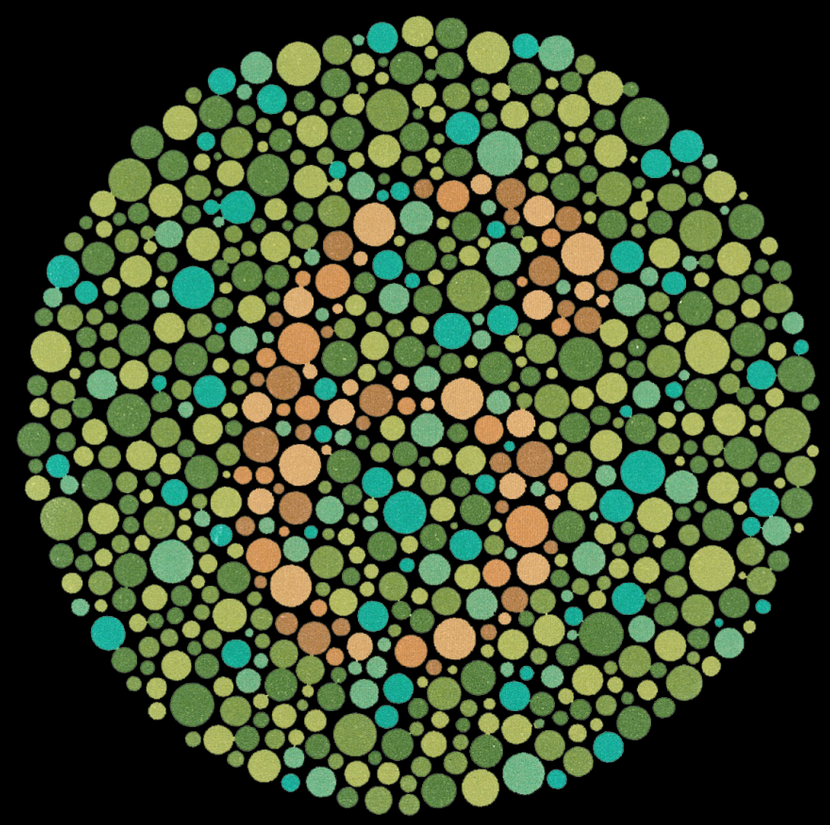
- Clearly identify the **role** of the figure.
- What is the **underlying message**?
- A figure should **tell a story** using data, legends, and labels, *without* having to consult a caption.
- The goal should be to efficiently convey the message at **first glance**.

Some simple rules for creating impactful figures

Use color effectively

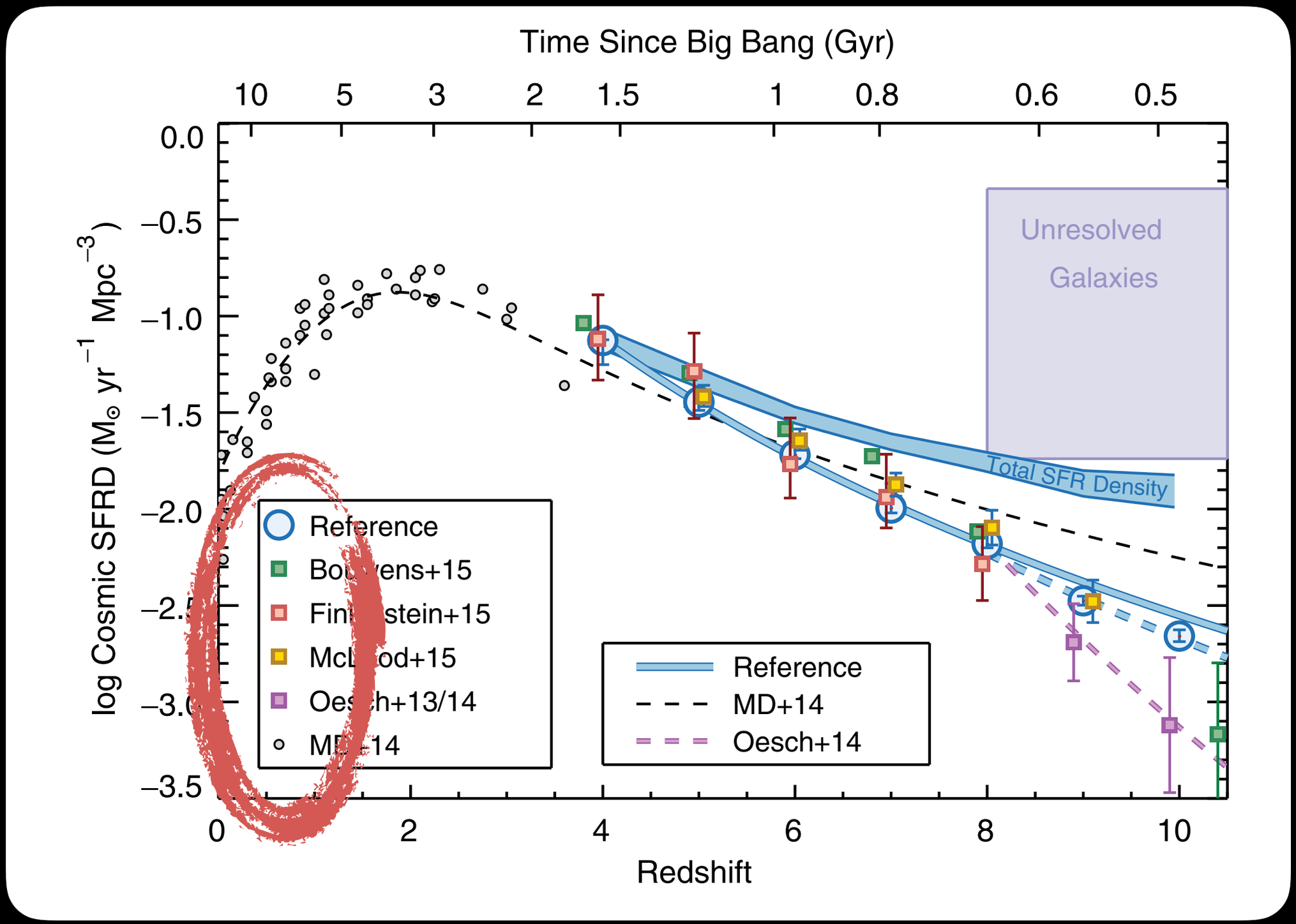
- Color can be your greatest ally or worst enemy if not used properly.
- **8% of men** are red-green color blind; 0.5% of women are.
- Avoid ``close" shades of green/red, red/brown, or blue/purple. Colors with high contrast help.
- Use a **different color** and a **different style** for lines and points.
- Use software to test your color scheme. When in doubt, ask your color deficient peers! (like me)



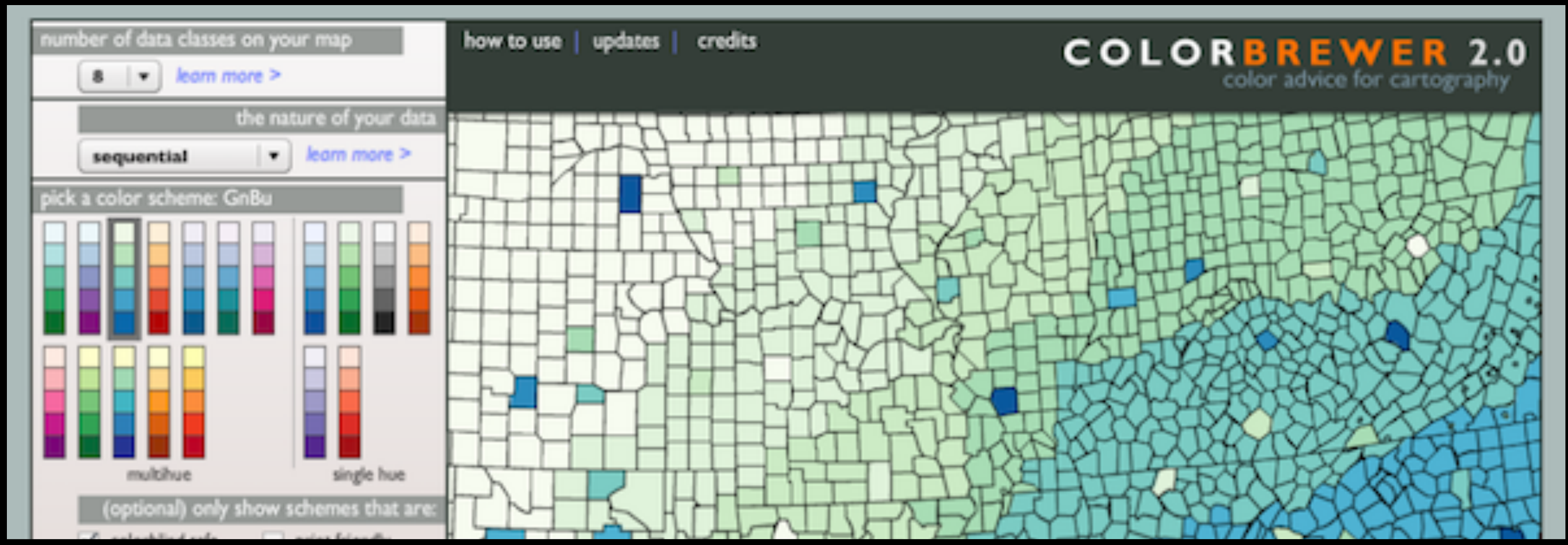


Example

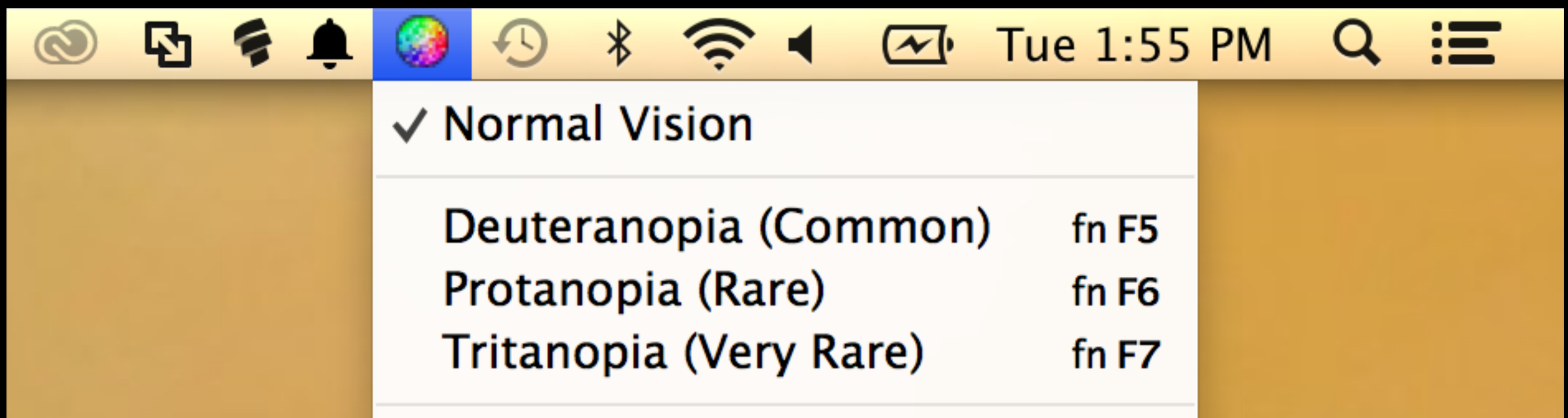
Finkelstein 2016 — The science is conveyed very well, but I can't tell the difference between Bouwens+15, Finkelstein+15 points. The blue hues all look the same too.



Color brewer

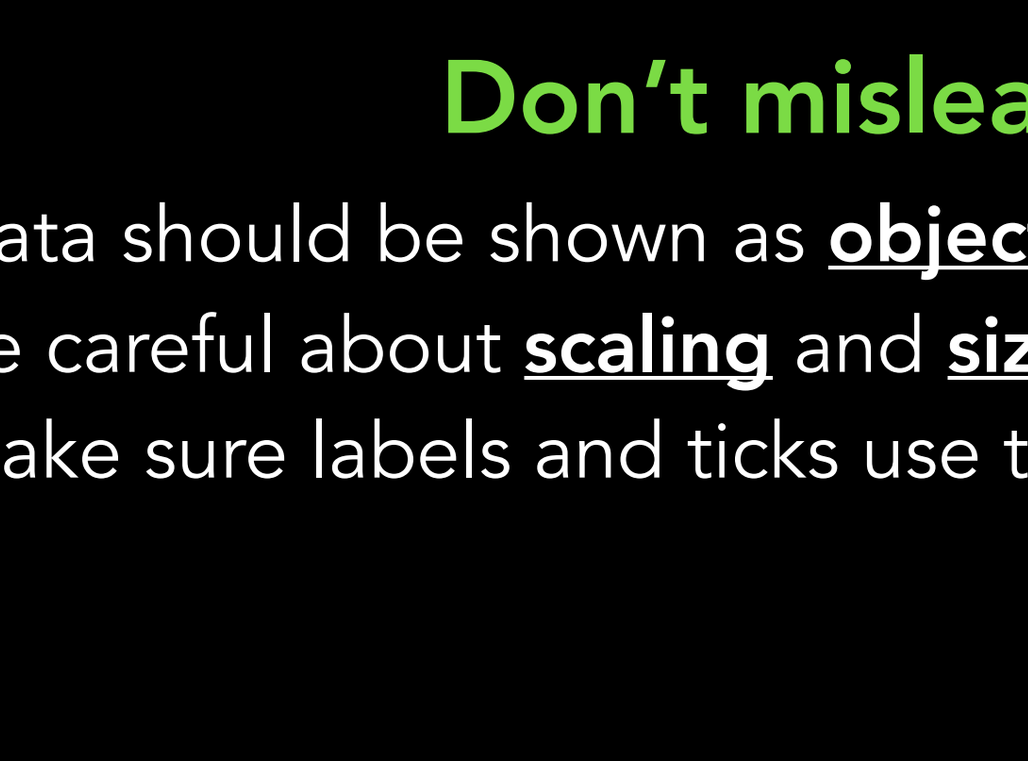


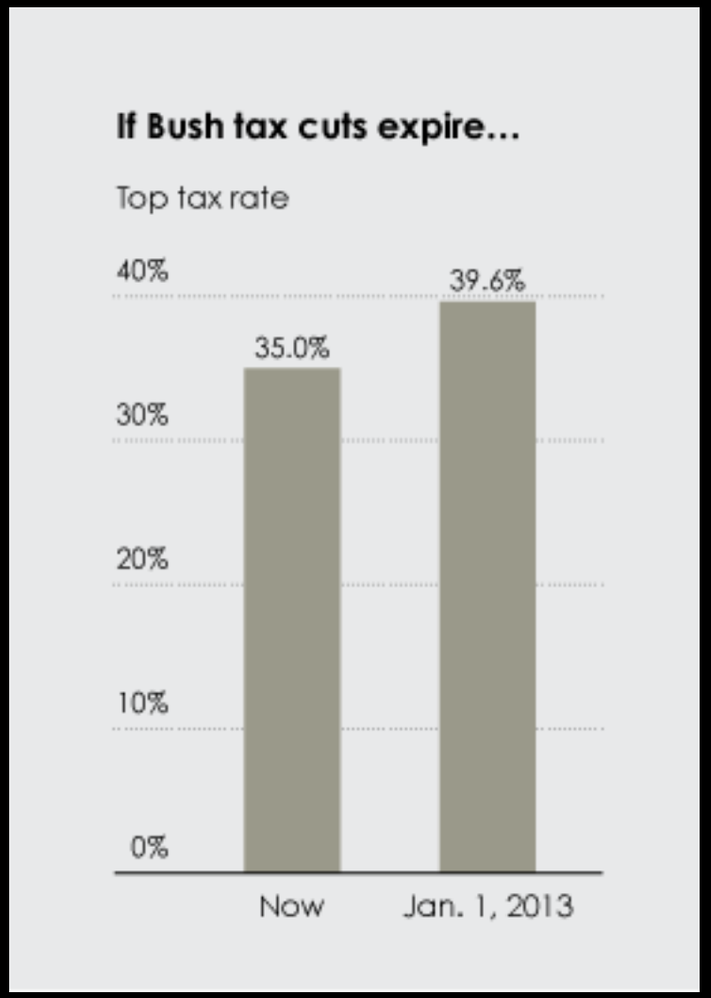
Color oracle



Don’t mislead the reader!

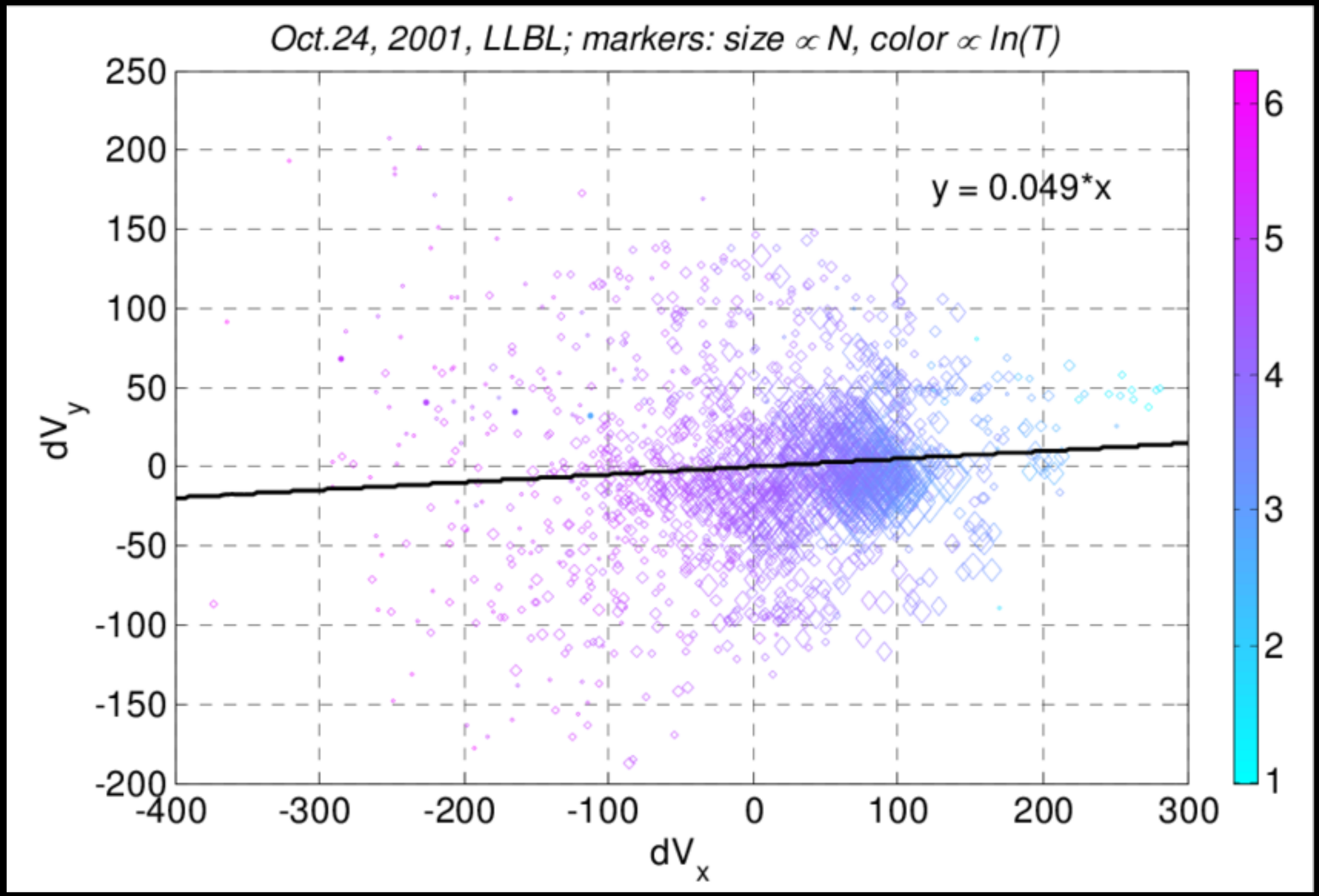
- Data should be shown as **objectively** as possible
- Be careful about **scaling** and **sizes**; this can mislead the reader
- Make sure labels and ticks use the full range of values





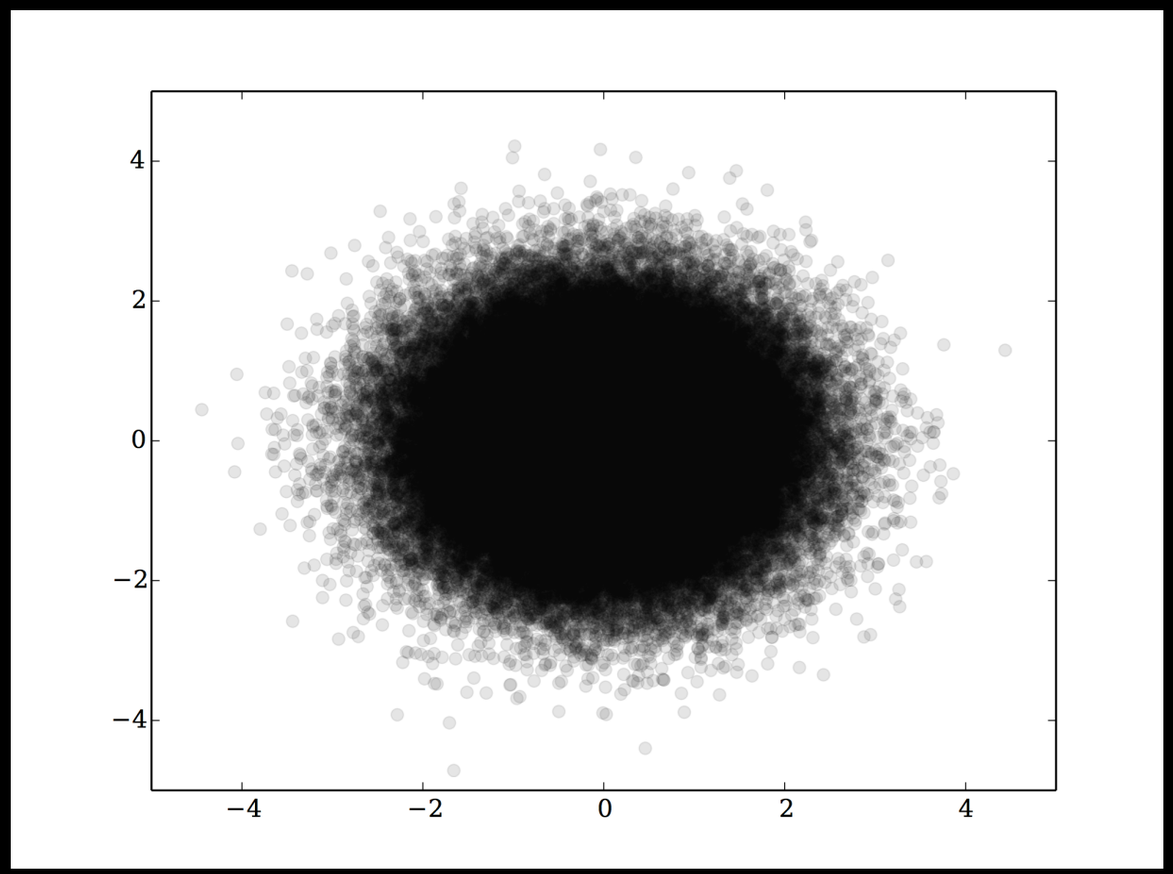
Credit: http://flowingdata.com/2012/08/06/fox-news-continues-charting-excellence/

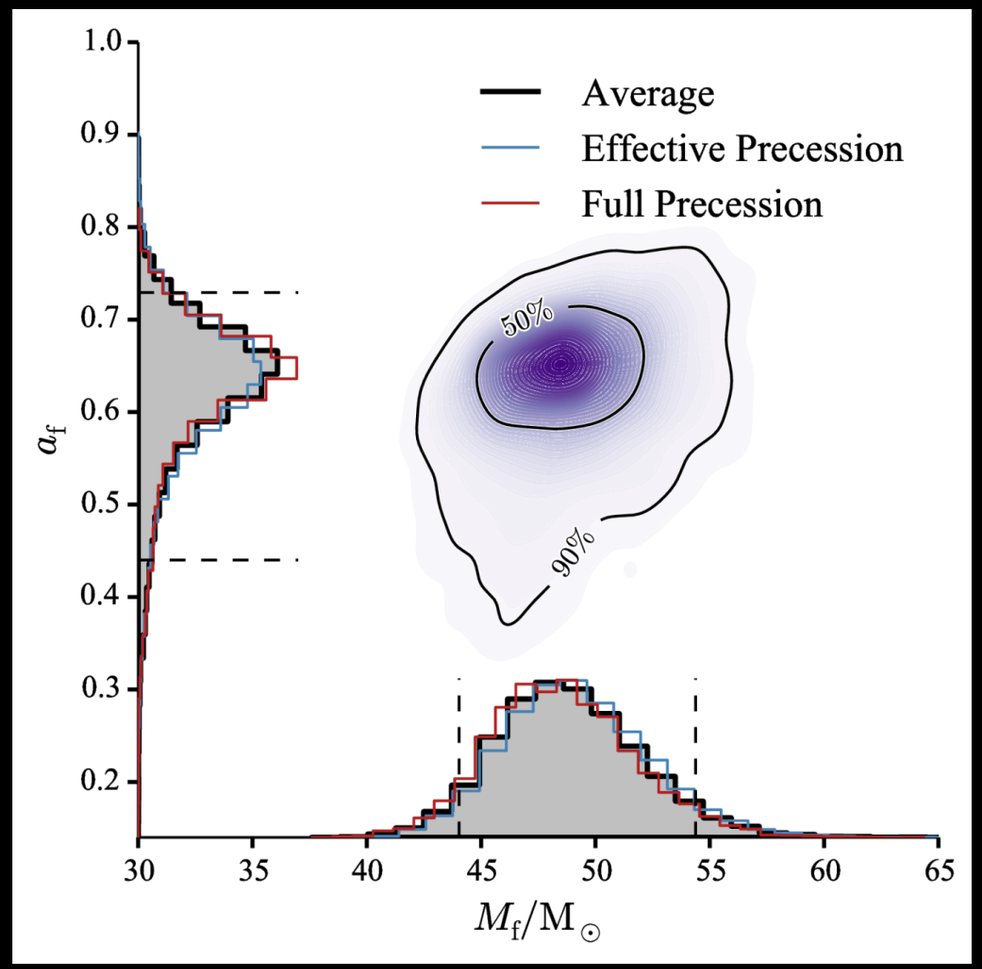
Don’t mislead the reader!



Avoid large image files

- Large files can cause PDF viewers to scroll slowly. In the worst cases, they hang (spinning wheel of death).
- Display large datasets or MCMC posteriors as contour plots, or a mixture of points and contours

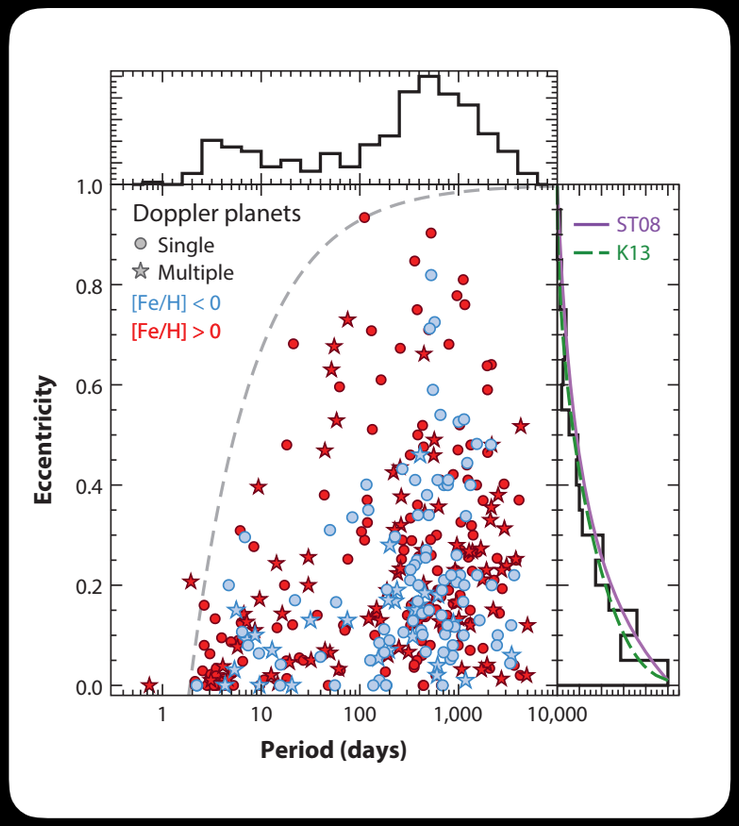




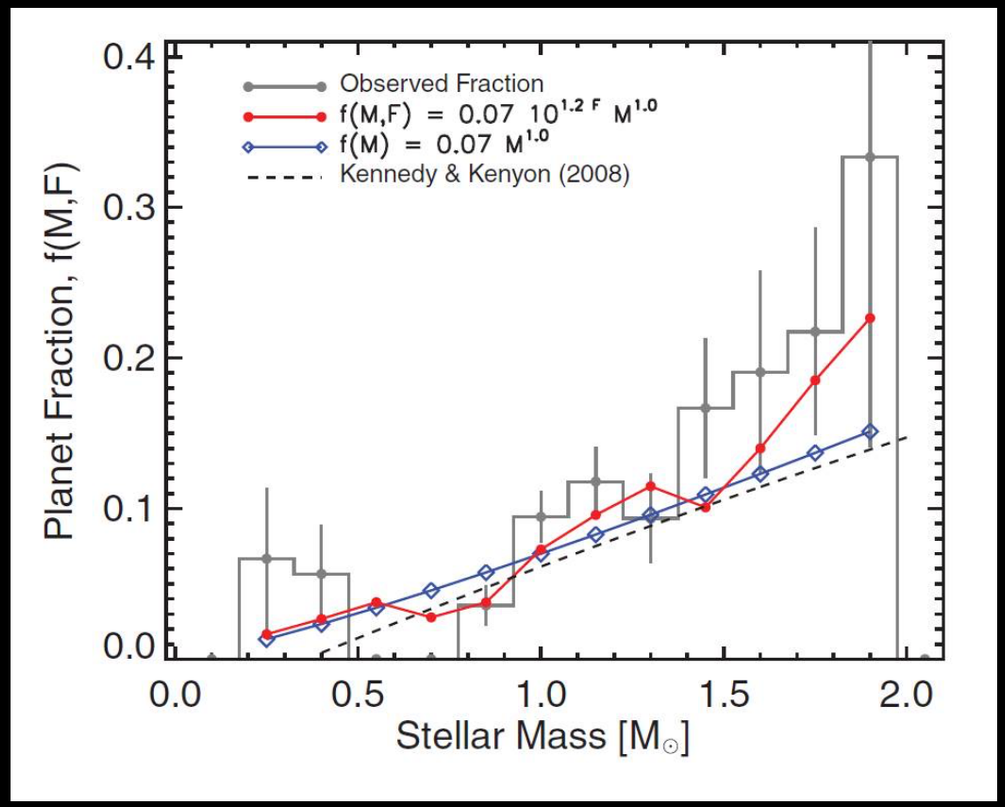
LIGO Scientific Collaboration,
LIGO VIRGO Collaboration 2017

Create slide-ready figures

- Make figures that can immediately be inserted into a talk.
  - Simple, memorable message
  - Thick borders
  - Each paper should have a “punchline” figure.
- You spent months to years on your research. Take the time to perfect your figures. Details matter!

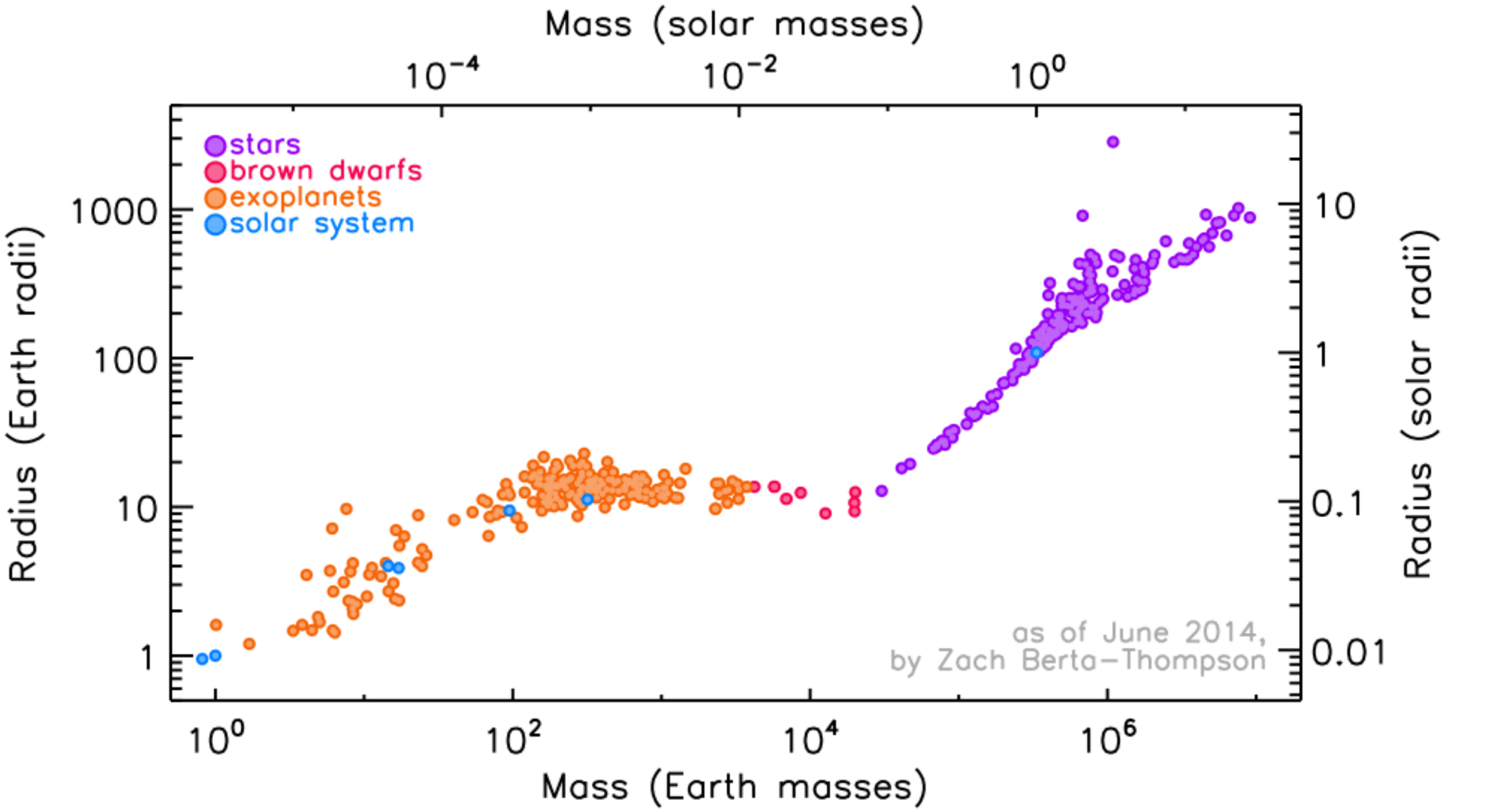


Winn & Fabrycky 2015

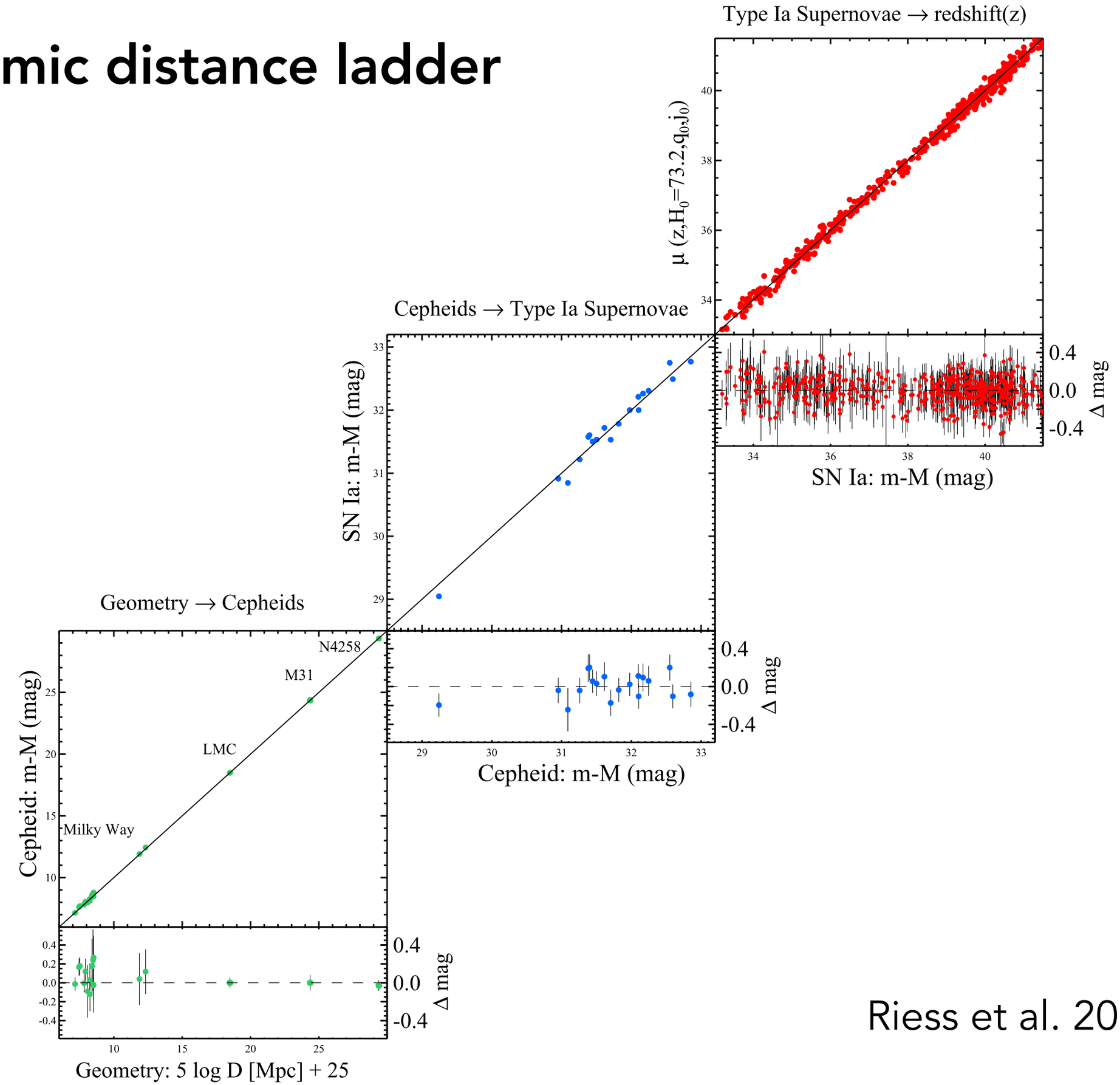


Johnson et al. 2010

...and put them on your website



The cosmic distance ladder



Riess et al. 2016

Other tips

- **Minimize white space**, but avoid overcrowding
- Use **postscript fonts**, not vector fonts
- Include **units** on axes
- Try to use a **constant color theme** throughout paper
- Don’t include more than you need to convey the message; sometimes **less is more**.
- Font size should be large— but not cartoonish.
- When useful, make use of all **four axes**.
- Use light colors to de-emphasize less important items, like error bars or fits through data.
- Include **minor ticks**
- Use **color bars** to provide a scale
- For the IDL users… sharpcorners.pro