

# Outlines

## Outlines → make writing more efficient

- Partially answers “what do I want to say?”
- Clarifies “work still to be done” and gives you a long lead time to get it done
- Can get high-value input from collaborators at an early stage.
- Reveals structural problems *early*, before investing time writing.

# What do I mean by “structural problems”?

Are you....

Explaining things in the wrong order?

Explaining too much at the same time?

Missing information?

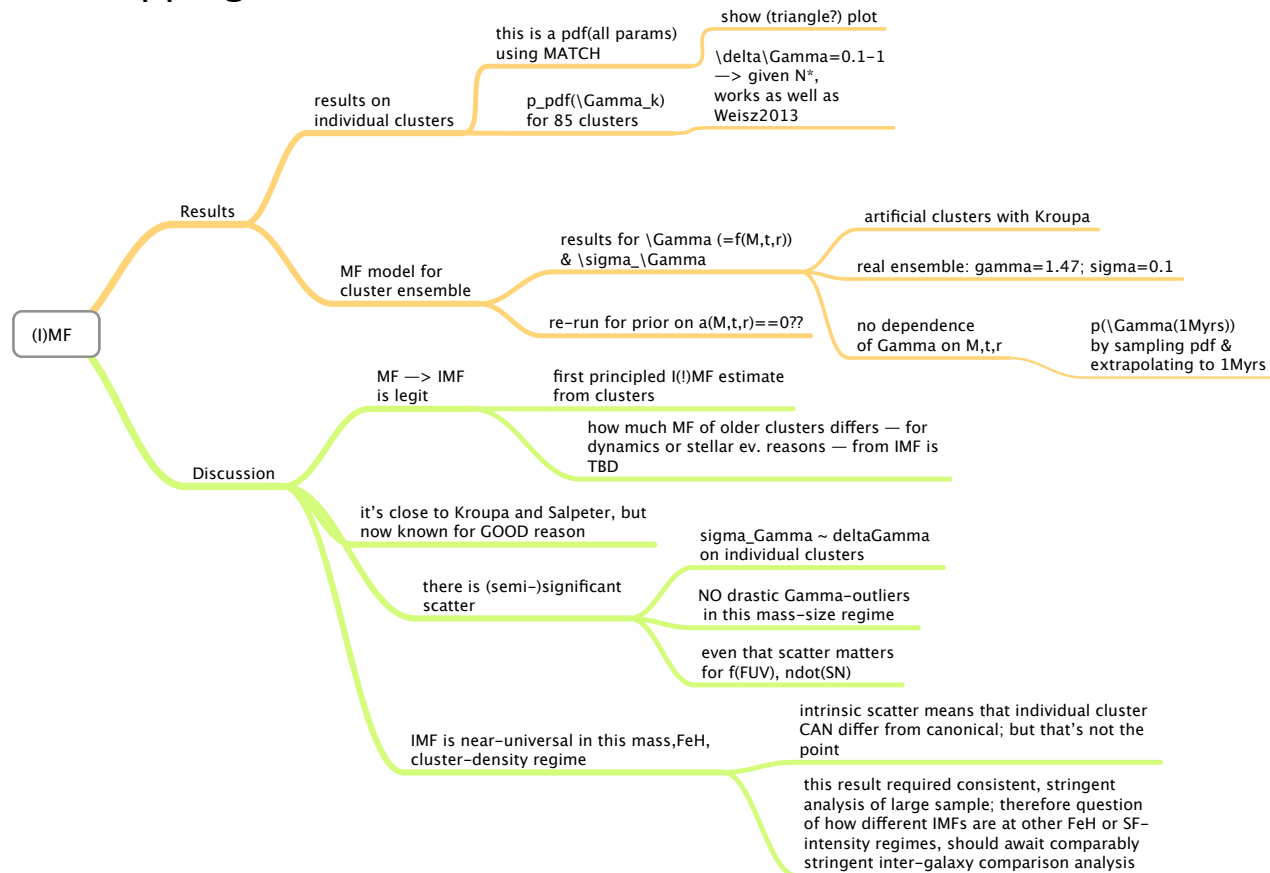
Motivation unconvincing?

Line of argument confusing?

# Structural Problems

- You can't just tweak words and sentences to fix these.
- You have to move or cur entire paragraphs and sections.
- Easy to fix EARLY before text is written.

# Mind Mapping



<http://mindnode.com>

Has free trial. Paid version lets you drag & drop nodes.

# Outline for Science Justification

Abstract: Summarizes the entire proposal

Section 1: Facts and summary of Sections 2-5

Section 2: The Problem/Motivation/Story

Section 3: The Target

Section 4: The Strategy: How will use Target +  
“key component” to solve the Problem

Section 5: Importance of the solution to  
subfield & Broader Impacts (legacy value)

# Abstract Outline

Facts

Importance of Facts

Impact within Sub Field

Problem

Goal – identify the “key component” that will solve the problem

We propose to...

Strategy – to utilize/generate the key component , (Justify HST/JWST, explain utilizing the “target”)

Suitability

Importance of Solution

Impact within Sub Field

Broader Impact

Out-of-field Impact

## New Models of the Milky Way's Dark Matter Distribution for the Era of High Precision Astrometry

Understanding the assembly history and dark matter distribution of our Milky Way (MW) is a major challenge for astrophysics. Thanks to the unique capabilities of HST, proper motions of satellite galaxies, globular clusters and stellar streams have been measured with accuracies of order  $\sim 0.05$  mas/yr ( $\sim 10$  km/s) at distances of 50-300 kpc. When combined with detailed models of the MW's halo potential, such measurements become high-precision tools to constrain the dark matter mass profile of the MW and compute accurate orbital histories of satellites. However, the MW hosts a pair of massive dwarf galaxies, the LMC and SMC, that contribute to its dark matter distribution and change the shape of the potential in a non-symmetrical, time evolving manner. To date, these effects have not been accounted for in existing models of the MW halo. We propose to develop high resolution simulations to quantify the time evolving structure of the MW's dark matter halo owing to the influence of the LMC and SMC. These novel models will enable rapid orbital integration of halo objects (satellites, globular clusters, stellar streams), using high accuracy HST proper motions, while also capturing the complex halo potential resulting from the LMC-SMC-MW interaction. The era of high-precision astrometry has arrived, yet we do not currently have an appropriate theoretical framework to study the assembly history of MW-like galaxies in the presence of massive satellite perturbers. Our proposed program is thus critical to ongoing HST programs and all efforts to understand the structure and evolution of the dark matter halo of our Galaxy and analogous systems like M31 and its massive satellite, M33.

Facts

Importance of Facts

Problem

Proposal

Strategy

Importance of Solution

Broader Impact