# Discourse Kit

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## Evidence & Reasoning Sentence Starters

Use these in Socratic Seminar, think–pair–share, and group inquiry activities. The goal is not fancy wording—it's clear scientific thinking.

### Claim (what you think is true)

- "A conservative interpretation is that..."
- "The figure suggests that..."
- "My current best claim is..."

### Evidence (what you're pointing to)

- "I'm basing that on _____ (axis/line/value/quote)..."
- "In the region where _____, the trend shows..."
- "The key detail is _____, which indicates..."

### Reasoning (why the evidence supports the claim)

- "That supports the claim because..."
- "If _____ increases, then _____ should change because..."
- "The physical story is: _____ → _____ → _____."

### Assumptions (what must be true)

- "This depends on the assumption that..."
- "We're implicitly assuming _____ (calibration / geometry / equilibrium / negligible dust)..."
- "If that assumption fails, the conclusion could change by..."

### Alternative explanations (how to avoid tunnel vision)

- "Another explanation consistent with the data is..."
- "A competing model would predict..."
- "These interpretations differ mainly in the assumption that..."

**Uncertainty (allowed; vagueness is not)**

- "I'm about ___% confident because…"
- "The biggest uncertainty is…"
- "I'm unsure whether _____ or _____, because the data don't constrain…"

**Discriminating tests (what would we measure next?)**

- "A measurement that would distinguish these is…"
- "If we observe ***, it would support model A; if we observe*** , it would support model B."
- "The next-best observation would be _____ because it reduces the degeneracy between…"

**Building on others (collaboration moves)**

- "I want to build on what _____ said by adding…"
- "I agree with _____ under the condition that…"
- "I interpret that differently because the evidence suggests…"

## Common Astronomy Inference Pitfalls

Astronomy is inference under constraints. These pitfalls are *normal*—the goal is to notice them early and build guardrails.

Use this sheet during problem-solving and seminar.

### 1) Mixing up what's measured vs what's inferred

**Guardrail:** Write "Observable:" and "Inference:" separately.
Example: flux is measured; distance is inferred using a model.

### 2) Confusing brightness with luminosity

- **Brightness (flux)** depends on distance.
- **Luminosity** is intrinsic power output.
  **Guardrail:** Ask: "Is this property distance-dependent?"

### 3) Treating a model assumption as a fact

Examples: circular orbits, equilibrium, "standard candle," negligible dust.
**Guardrail:** Say: "This conclusion holds *if* _____."

### 4) Over-claiming (data show X → therefore theory Y is true)

Data usually constrain a *family* of models.
**Guardrail:** Ask: "What else could explain this pattern?"

### 5) Ignoring selection effects ("what got into the dataset?")

What you observe is shaped by detection limits and survey design.
**Guardrail:** Ask: "What might be missing, and why?"

### 6) Forgetting units or axis scaling (especially log axes)

A straight line on a log plot means something different than on a linear plot.
**Guardrail:** Always write the units and identify linear vs log.

### 7) Confusing correlation with causation

Two quantities can vary together due to a third variable or measurement bias.
**Guardrail:** Ask: "What mechanism connects them? What would break the trend?"

### 8) Treating uncertainty as a footnote

Uncertainty is part of the claim.
**Guardrail:** Try: "I'm ~___% confident because. . . " and name your biggest uncertainty.

### 9) Single-figure tunnel vision

A great plot can still be misleading without context (calibration, sample, method).
**Guardrail:** Ask: "What information is missing that could change interpretation?"

### The most scientific question you can ask

**"What observation would discriminate between these explanations?"**