Methodological Best-Practices Checklist

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This checklist outlines recommended practices for comparing large-survey observations with numerical models, with particular emphasis on survey selection functions, uncertainty quantification, and reproducibility.

Selection and sample definition

- Document target-selection rules, sky coverage, magnitude limits, quality cuts, and spatial/kinematic completeness.
- Propagate the survey selection function or construct forward-model comparisons in observed space.
- Distinguish selection-induced structures from astrophysical structures using validated mocks.

Uncertainty and calibration

- Report random and systematic uncertainties in distances, ages, kinematics, and abundances.
- Test sensitivity to calibration choices, priors, and survey-to-survey zero-point differences.
- Identify regimes where the inference is weak, model-dependent, or not yet validated.

Simulation-observation comparisons

- Apply equivalent observational masks and measurement uncertainties to synthetic catalogs.
- State assumptions and numerical resolution limits; assess sensitivity to sub-grid physics.
- Compare more than a single summary statistic where multiple mechanisms can mimic a signal.

Reproducibility and communication

- Provide sufficient metadata, version information, and documented processing steps to reproduce key results.
- Make analysis code or derived data products accessible where licensing and collaboration rules allow.
- Separate demonstrated findings, working interpretations, and unresolved questions in presentations and reports.

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