David Merritt, "Cosmology and Convention," *Studies in History and Philosophy of Modern* Physics 57 (2017) 41–52

Main claims:

1. Dark matter and dark energy arise through the use of Popper's deprecated "conventionalist stratagem" as a way of avoiding falsification.

2. The anomaly of the (purportedly) unexplained mass discrepancy-acceleration relation survives through another version of the conventionalist stratagem. It is ignored.

3. The cosmologists' "concordance" model is weaker support for the standard model of cosmology than the convergences celebrated in Perrin's multiple measurements of Avogadro's number.

Only thesis 1. supports a claim of convention.

Thesis 2 urges irresponsibility among theorists
and thesis 3 (I suspect) is an afterthought forced by an unhappy referee.

Merritt's summary of the main arguments:

Dark matter

"1. Newton's theory of gravity and motion is correct (in the weak- field regime appropriate to galaxies).

2. In the absence of unseen mass, Newton's laws imply that galaxy rotation curves must fall.

3. Galaxy rotation curves are observed to be asymptotically flat.

∴ There must be dark matter."

Dark energy

1. Einstein's theory of gravity and motion is correct.

2. In the absence of a universal component with the properties of dark energy, Einstein's equations imply that the cosmological expansion rate must decrease over time.

3. The expansion rate is observed to increase over time.

∴ There must be dark energy.

Popper's Conventionalist Stratagem (as summarized by Keuth, *The Philosophy of Karl Popper*. When threatened with possible falsifiers:	**Popper's remedies**
"(i) we may introduce ad hoc hypotheses (which make refuting evidence seem irrelevant);"	"As regards auxiliary hypotheses we decide to lay down the rule that only those are acceptable whose introduction does not diminish the degree of falsifiability or testability of the system in question, but on the contrary, increases it..."
"(ii) we may modify the so-called ostensive definitions (so as to alter the content of a hypothesis and thus possibly its truth value);"	'…changes in definitions are permissible, but "they must be regarded as modifications of the system, which thereafter has to be re-examined as if it were new" '
"(iii) we may doubt the reliability of the experimenter (and declare his observations that threaten the tested theory to be irrelevant);"	'Popper says only "As to the two remaining points in our list...we shall adopt similar rules. Inter-subjectively testable experiments are either to be ac- cepted, or to be rejected in the light of counter-experiments." "
"(iv) we may doubt the acumen of the theoretician (who does not produce ideas that can save the tested theory)."	

Potential Falsifier	**Why escape in conventional**
Anomalous galactic rotation curves	"In this limited sense, the dark matter hypothesis can be said to be non-falsifiable, since essentially any observed rotation curve can be fit by adjusting the assumed dark matter density appropriately." "non-detection will never constitute a falsification of the cold-dark-matter hypothesis."
Anomalous galactic acceleration	"The dark energy hypothesis allows one to fit any observed cosmic expansion history by adjusting the dependence of ε and p on time24 (Woodard, 2007). In this limited respect, the dark energy hypothesis is not falsifiable." "Can one imagine designing a similar experiment that tests the dark energy hypothesis? The straightforward answer is "no".
The mass discrepancy–acceleration relation	"Framed as a prediction, the mass discrepancy–acceleration relation clearly satisfies Popper's criterion for a 'severe' test ("highly improbable .." "the mass discrepancy–acceleration relation has been dealt with via the third of Popper's conventionalist stratagems: It has been ignored."

The mass discrepancy–acceleration relation: "Ignored"

Merritt surveys 34 graduate level cosmology texts dated 2005-2016. None discuss the relation.

Merritt's citations include repeated references to Milgrom (of MOND), who is also acknowledged.

Suspicion: that there is a problem is an unsuccessful talking point of MOND proponents. They have been unsuccessful is getting the mainstream to share the worry.

My Diagnosis

The analysis relies on a simple-minded Popperian analysis and thus can at best deliver simple-minded results.

The general claim of conventionality conflates an issue of degree with a simple dichotomy:
Merritt's analysis: is X conventional or factual?
Correct analysis: to what extent is X fixed by the evidence and to what extent is it underdetermined by the evidence?

Here is a test of whether an account of evidential relations is sensitive enough to deal with cosmology. Can it separate the two cases of dark energy and dark matter, coming to different verdicts on each? Popper's account fails the test.

Thesis 3.
The claim is that the concordance model provides confirmation for a set of parameters, but no independent confirmation of the value any single parameter. (This last point 3 is anomalous in the paper. I am guessing it was added to fend off a pesky referee who didn't find points 1 and 2 convincing.)