Referee Report on "CMB Experiments and AGN Studies" by Bruce Partridge

Edoardo Livolsi

Psi Research Institute Prague

(Dated: December 22, 2025)

RECOMMENDATION: REJECT

SUMMARY

The manuscript entitled "CMB Experiments and AGN Studies" provides a descriptive overview of possible connections between CMB surveys and AGN astrophysics. However, the work does not satisfy the scientific, methodological, or quantitative standards required for publication in an APS journal.

The manuscript contains no equations, no modelling, no statistical formulation, no derivations, and no original scientific results. It reads as an informal tutorial or outreach summary rather than a research article.

For these reasons, my recommendation is **Reject**.

1. ABSENCE OF SCIENTIFIC CONTENT

The author explicitly states that his role is "more salesman than scientist". The manuscript does not present a hypothesis, a model, a quantitative method, or a falsifiable prediction. These elements are essential for a scientific publication.

2. NO PHYSICAL MODELLING OF AGN EMISSION

AGN spectra, polarization, and frequency scaling are discussed without any radiative-transfer model, jet physics, or dynamical framework. All statements are qualitative and descriptive. No analytical relation is derived or tested.

3. NO EQUATIONS OR STATISTICAL METHODOLOGY

The manuscript contains zero equations. No likelihood, covariance, estimator, or uncertainty propagation is provided. Statistical claims, such as log-normal polarization distributions, are stated without derivation or justification.

4. MISCHARACTERIZATION OF CMB SURVEY CAPABILITIES

The manuscript acknowledges that CMB surveys do not resolve AGN spatial structure, yet simultaneously claims that they provide insight into AGN physics. CMB maps cannot provide morphological or component-level information on AGN. This contradiction is not addressed.

5. FOREGROUND SUBTRACTION IS NOT PHYSICAL MODELLING

Template subtraction is treated as if it were a physical method, whereas it is a purely statistical operation not derived from any dynamical principle. The manuscript does not distinguish between phenomenological cleaning and physical inference.

6. NO ORIGINAL RESULTS

All figures and statements derive from previous Planck, ACT, and SPT publications. No new measurements, simulations, or theoretical developments are presented.

7. CONCLUSION ACKNOWLEDGES LACK OF SCIENTIFIC CONTRIBUTION

The final section states the hope that "some of the data may be of use", which implicitly confirms the absence of a scientific result or well-defined contribution.

FINAL ASSESSMENT

The manuscript does not meet APS publication standards. Its content is descriptive, non-quantitative, and lacks scientific novelty. Substantial restructuring and the development of

a real analytical or observational framework would be required to elevate it to a publishable scientific study.

Recommendation: Reject.

APPENDIX A: VARIATIONAL CONSISTENCY ANALYSIS AND COMPARISON WITH THE UNIVERSAL PSI FRAMEWORK

A.1 Purpose of this Appendix

This appendix provides a technical comparison between the physical requirements of a closed variational formulation and the purely descriptive, non-generative framework used in the manuscript "CMB Experiments and AGN Studies". The aim is not to introduce new scientific claims, but to document the structural reasons why the manuscript cannot, in principle, support physical inference.

A.2 Requirement of variational closure

Any physical observable $O(x)$ must arise from a generating functional $F[\Phi]$ of the underlying fields Φ. In a consistent theory,

$$\frac{\delta F}{\delta \Phi^\dagger(x)} = 0$$

must produce both the dynamics and the correlations of the fields from which observables are constructed.

In the manuscript under review, the mechanisms invoked for AGN emission, polarization, spectral indices, and frequency behavior are descriptive rather than variational. No functional is provided, and therefore no field equation can be derived.

A.3 Universal Psi Equation as a closed generative structure

For reference, a closed variational formulation is exemplified by the Universal Psi Equation, defined by the stationary condition

$$\frac{\delta}{\delta \Psi^\dagger(x)} \left\{ \left| \sum_{i,j} \Psi_i^\dagger \Gamma \Psi_j \right|^2 - \lambda_1 \sum_i (\Psi_i^\dagger \Psi_i - 1)^2 - \lambda_2 \sum_{i,j,k} \mathrm{Tr} \left[\Gamma (\Psi_i \Psi_j^\dagger - \Psi_k \Psi_i^\dagger) \right]^2 \right\} = 0.$$

A closed variational principle ensures:

1. The frequency behavior of any emission process is emergent, not imposed.

2. The spatial coherence or decoherence of fields follows from the operator Γ, not from templates.

3. Beam interactions follow from the same functional, ensuring internal consistency.

4. Polarization states are generated by coherent bilinears of the spinorial fields, not by phenomenological averaging.

These requirements contrast with the manuscript's use of descriptive foreground templates, non-variational frequency scaling, and statistical assumptions without physical derivation.

A.4 Lack of derivation for AGN observables

In the manuscript reviewed, AGN observables such as flux density, polarization fraction, and spectral energy distributions are presented as empirical summaries without derivation from any underlying field equation. For example:

- Polarization behavior is described statistically, not dynamically.
- Spectral indices are quoted but not derived.
- Frequency scaling is presented phenomenologically.
- Beam convolution is treated as an external artifact, not as part of the physical system.

Without a generative functional, none of these quantities can be tested, falsified, or predicted, and thus cannot support claims of physical insight.

A.5 Structural consequence: underdetermination

If observables are not generated by a variational principle, then any number of parametric descriptions can reproduce the same data. This leads to underdetermination: multiple incompatible physical models can fit the same phenomenology.

In contrast, in a closed system such as the Universal Psi framework, the functional constraints provide a unique mapping from field configurations to observables, eliminating degeneracy at the level of physical interpretation.

A.6 Incompatibility between descriptive frameworks and generative physics

The manuscript under review uses template subtraction, empirical SEDs, and heuristic classification of AGN sources. These methods:

1. do not arise from a functional extremization,
2. do not enforce consistency across frequencies,
3. do not relate beam response to sky fields,
4. do not couple polarization to dynamical variables.

Therefore, they cannot be used to validate or test a physical model.

A.7 Conclusion

The absence of a variational generator in the manuscript prevents any form of physical inference regarding AGN behavior, frequency spectra, polarization, or instrumental response. This technical limitation is independent of data quality and arises solely from the non-generative nature of the modelling choices.

This appendix is included for transparency and to clarify the mathematical basis of the structural critique summarized in the referee report.

APPENDIX B: FUNCTIONAL INTEGRITY TEST FOR GENERATIVE PHYSICAL MODELS

B.1 Purpose

This appendix defines the six necessary conditions for any physical model to be considered generative, self-consistent, and derivable from a closed variational principle. These criteria are applied implicitly when evaluating the manuscript under review.

B.2 Criterion 1: Existence of a generating functional

A physical model must be derived from a functional $F[\Phi]$ of the fields Φ such that the equations of motion follow from

$$\frac{\delta F}{\delta \Phi^\dagger(x)} = 0.$$

If no such functional exists or is not provided, the model is descriptive rather than generative.

B.3 Criterion 2: Closure of variation

All observables $O(x)$ must be expressible as functionals of the fields appearing inside $F[\Phi]$. If external templates, empirical corrections, or heuristic parameters are required, the system is not closed.

B.4 Criterion 3: Coherence of spectral and spatial structure

Frequency scaling, spatial structure, and polarization must arise from the same field configuration. If these properties are assigned independently or are fitted phenomenologically, the model fails coherence.

B.5 Criterion 4: Deterministic generation of correlations

Correlation functions must arise by functional differentiation of the generating functional, e.g.

$$G_{ij}(x,y) = \frac{\delta^2 F}{\delta\Phi_i^\dagger(x)\,\delta\Phi_j(y)}.$$

If correlations are defined purely statistically, without derivation, the model is not predictive.

B.6 Criterion 5: No empirical degrees of freedom

A variational model cannot include free templates, empirical curves, or arbitrary foreground corrections. These elements introduce external degrees of freedom and break generativity.

B.7 Criterion 6: Internal consistency under perturbation

Perturbed solutions must remain solutions of the same generating functional. If small perturbations require new parameters or re-fitting, the model is unstable and cannot be physical.

B.8 Summary

The manuscript under review fails all six criteria, as it uses empirical templates, non-variational descriptions, and phenomenological scaling relations. Its framework is therefore non-generative and unsuitable for physical inference.

APPENDIX C: COMPARISON BETWEEN THE UNIVERSAL PSI FRAMEWORK AND DESCRIPTIVE AGN/CMB MODELS

C.1 Purpose

This appendix presents a concise comparison between a closed variational model (Universal Psi Equation) and the descriptive, template-based methodology used in AGN/CMB analyses. The table is formatted to fit REVTeX margins.

C.2 Comparison Table

Universal Psi Framework	**AGN/CMB Descriptive Model**
Derived from a single variational functional	No generating functional present
Observables arise from field bilinears	Observables defined empirically
Spectral laws are emergent	Frequency scaling fitted phenomenologically
Polarization from coherent operators Γ	Polarization averaged statistically
Beam effects encoded in the same functional	Beam treated as external correction
No free parameters or templates	Requires templates and foreground fits
Correlations generated by differentiation	Correlations inferred by statistics
Closed dynamical system	Underdetermined phenomenology
Predictive and falsifiable	Non-predictive, descriptive only

C.3 Summary

The AGN/CMB framework relies on empirical adjustments and template subtraction, while the Universal Psi model generates all structures from a closed variational principle. The two paradigms are mathematically incompatible.

APPENDIX D: EMERGENT MAJORANA STRUCTURE IN THE UNIVERSAL PSI FRAMEWORK

D.1 Purpose

This appendix provides a minimal derivation of how a Majorana-type mass structure arises naturally from the Universal Psi Equation without being postulated.

D.2 Bilinear self-conjugate sector

Consider the bilinear spinorial combination

$$M(x) = \Psi^\dagger(x)\,\Gamma\,\Psi(x),$$

where Γ is the coherence operator appearing in the functional. A necessary condition for stationarity is the self-conjugacy relation

$$M(x) = M^*(x),$$

which implies that the relevant degrees of freedom behave as real spinorial components in the variational extremum.

D.3 Majorana-like constraint

The stationarity condition of the functional imposes

$$\Psi(x) = \Gamma\,\Psi^*(x),$$

which is the defining constraint of a Majorana field. Importantly, this constraint is not imposed but arises automatically as the consistency condition necessary for extremizing the coherent bilinear term.

D.4 Emergent mass scale

The quadratic term

$$\left|\sum_{i,j} \Psi_i^\dagger \Gamma \Psi_j\right|^2$$

generates an effective mass parameter m_{eff} of the form

$$m_{\text{eff}} \propto \left\langle \Psi^\dagger \Gamma \Psi \right\rangle,$$

showing that mass is an emergent quantity determined by the coherent domain structure, not a free parameter. This directly contrasts with the Standard Model, where the neutrino mass is inserted by hand.

D.5 Consequence: Absence of a Dirac sector

Because the field obeys the self-conjugacy condition, no independent left-right phase degree of freedom survives. Therefore, a Dirac-type mass term cannot arise. This is a purely variational outcome.

D.6 Summary

The Universal Psi Equation naturally produces a Majorana-type structure and an emergent mass scale from its coherent bilinears. This structure cannot be replicated by descriptive AGN/CMB models, which lack an underlying variational engine capable of generating intrinsic masses.