Philosophy of Physics

NUS Presidential Conference

December 11-13, 2025

Republic of Singapore Yacht Club
52 W Coast Ferry Rd, 126887

About

What is it to be a physical law? How should we interpret the nomic equations which express our best physical theories, such as the quantum field theories of the standard model? Do physical theories support distinctive kinds of explanations, and if so, why? These questions, and others like them, have received considerable attention from philosophers in recent decades. The purpose of this conference—which is part of a larger series of conferences in the philosophy department at NUS—is to bring researchers together, to facilitate discussion of these issues in the philosophy of physics.

Speakers

Emily Adlam (Chapman)
Nina Emery (Holyoke)
Jens Jäger (UT Austin)
Alex Meehan (Wisconsin)
Michael Miller (Toronto)
Laura Ruetsche (Michigan)
David Wallace (Pitt)
Porter Williams (Pitt)
Alastair Wilson (Leeds)

Official Discussants

Gordon Belot (Michigan)
Harjit Bhogal (Maryland)
Ben Blumson (NUS)
Francisco Calderón (Michigan)
Clive Aw Cenxin (NUS)
Eugene Chua (NTU)
James Fraser (Panthéon-Sorbonne)
David Glick (Davis)
Zachary Goodsell (NUS)
Bixin Guo (Macalester)
Michael Townsen Hicks (Glasgow)
Josh Hunt (Syracuse)
Wang Yen Lee (NUS)
Dan Marshall (Lingnan)
Siddharth Muthukrishnan (Harvard)
Mike Pelczar (NUS)
Lavinia Picollo (NUS)
Jerome Romagosa (Davis)
Moonyoung Song (NUS)
Dan Waxman (NUS)

Organizers: Yuang Chen (NUS), Melina Loo Shi Jie (NUS), and Isaac Wilhelm (NUS).
Sponsors: NUS Presidential Young Professorship grant.

Schedule

Dec 11

9:30–9:55am	Coffee and refreshments
9:55–10am	Opening remarks
10–11:30am	*Haecceitistic Boltzmann Entropy* Jens Jäger (UT Austin)
11:30–11:45am	Break
11:45–1:15pm	*What if our laws are non-Markov and 'gappy'? Laws and probability in Indivisible Quantum Theory (based on joint work with Emily Adlam)* Alex Meehan (Wisconsin)
1:15–3pm	Lunch: RSYC
3–4:30pm	*TBD* Emily Adlam (Chapman)
4:30–4:45pm	Break
4:45–6:15pm	*Shut Up and Calculate in the Everett Interpretation* David Wallace (Pitt)
7pm	Dinner: Whole Earth (76 Peck Seah St., 079331)

Dec 12

9:30–10am	Coffee and refreshments
10–11:30am	*Path Integrals and Nomological Possibility* Porter Williams (Pitt)
11:30–11:45am	Break
11:45–1:15pm	*Narratability Failure in Quantum Field Theory* Michael Miller (Toronto)
1:15–3pm	Lunch: RSYC
3–4:30pm	*Aims, contents, attitudes* Laura Ruetsche (Michigan)
4:30–6:30pm	Activity: walk along Singapore River
7pm	Dinner: Publico (1 Nanson Rd., 238909)

Dec 13

9:30–10am	Coffee and refreshments
10–11:30am	*Simplicity of Fit: When and Why it Matters* Nina Emery (Holyoke)
11:30–11:45am	Break
11:45–1:15pm	*Physical Grounding* Alastair Wilson (Leeds)
1:15–1:20pm	Closing remarks
2–6pm	Activity: hike in Bukit Timah
7pm	Dinner: Bhoomi (1 Claymore Drive #01-05, 229594)

Abstracts

Dec 11

Haecceitistic Boltzmann Entropy

Jens Jäger (UT Austin)

Haecceitism is the view that there are possibilities which differ from actuality only in which individuals occupy which qualitative roles—for example, two classically identical particles may possibly "swap places" without any qualitative difference in the world. A haecceitistic Boltzmann entropy of an ideal gas naturally counts cross-particle permutations. For a gas of N particles, this yields a systematic overcount by a factor of N! compared to anti-haecceitistic Boltzmann entropy. This is a version of "Gibbs' paradox": haecceitistic Boltzmann entropy ends up neither additive nor homogenous of degree 1, and it seemingly delivers incorrect single-system differentials (chemical potentials), apparently undermining a haecceitistic reduction of thermodynamics. Against this, I defend a new haecceitistic account that keeps full haecceitistic counting everywhere and redefines local entropies as complement-conditional haecceitistic entropies. The associated aggregation rule is a version of the probabilistic chain rule. This proposal (i) is empirically equivalent to the standard anti-haecceitistic theory, (ii) preserves correct equilibrium conditions and differential structure, (iii) satisfies non-arbitrariness conditions, (iv) is recognizably haecceitistic, and (v) recovers effective 1-homogeneity in a large-environment limit. The Gibbs-style worry does not provide a good scientific argument against haecceitism.

What if our laws are non-Markov and 'gappy'? Laws and probability in Indivisible Quantum Theory (based on joint work with Emily Adlam)

Alex Meehan (Wisconsin)

There has been growing interest in a class of physical theories according to which the fundamental dynamical laws are (i) not just probabilistic, but non-Markov, and (ii) are in a certain sense imprecise or 'gappy'. This talk investigates whether extant metaphysical accounts of laws, such as production-based governing accounts, Best System accounts, and constraint-based accounts, can accommodate these features. As our main case study, we will focus on a theory that exhibits both (i) and (ii), namely the indivisible approach to quantum mechanics developed by Barandes (2025).

Quantum Mechanics and the Large Reference Limit

Emily Adlam (Chapman)

NA

Shut Up and Calculate in the Everett Interpretation

David Wallace (Pitt)

Physicists and philosophers alike often talk about the measurement problem as a problem of underdetermination: we have lots of empirically equivalent interpretations, so we choose between them by appealing to their extra-empirical virtues and vices - or else we don't bother, and just shut up and calculate. But this is an illusion: the measurement problem turns on underlying disagreements in physics about what the quantum formalism is or should be and how it is applied. I identify three Views one could take of quantum theory: the Modificatory View (the formalism is irretrievably broken, can be applied only through ad hoc moves, and must be replaced); the Lab View (quantum mechanics is inherently some kind of calculus of observation, in which notions of 'information' and 'observer' are conceptually central); the Unitary View (quantum mechanics is an always-unitary, dynamical theory; measurement is just one more interaction and an observer is just one more physical system; we should worship in the Church of the Larger Hilbert Space). As I will argue, the first two views are not at present scientifically viable approaches to quantum mechanics, whatever their philosophical merits. Only the Unitary View has the resources to make sense of contemporary applications of quantum mechanics; its problems, if any, are purely philosophical.

Dec 12

Path Integrals and Nomological Possibility

Porter Williams (Pitt)

There are multiple ways to characterize the dynamical evolution of a quantum system. All are equivalent, in some sense. In the path integral framework, one integrates over "all possible trajectories" connecting an initial state to a final state. Reflecting on what we mean by "possible trajectories" in this context turns out to be worthwhile, not least for illuminating the sense in which these distinct characterizations of dynamical evolution are equivalent.

Narratability Failure in Quantum Field Theory

Michael Miller (Toronto)

A number of arguments have been advanced which suggest that relativistic quantum theories will exhibit a phenomenon called narratability failure (Aharonov and Albert 1984; Myrvold 2002; Albert 2016), though significant limitations on the failure of narratability have been established by Myrvold (Myrvold 2016). Extant arguments in the debate are inconclusive because they address quantum mechanics in a quasi-relativistic setting, rather than treating the problem directly in quantum field theory. In this talk I employ the separating property of states in quantum field theory to extend Myrvold's limitative results, and I present an argument which suggests that the possible worlds of quantum field theory are almost always narratable.

Aims, contents, attitudes

Laura Ruetsche (Michigan)

Philosophies of science differ with respect to (among other things) their accounts of (i) the aims of science, (ii) the contents of physical theories, and (iii) the attitudes it's epistemically responsible to adopt toward those contents. One way to advocate for a philosophy of science is to argue that its account of aims, contents, and attitudes "makes better sense of science, and of scientific activity" (van Fraassen 1980, 73) than other accounts on offer. Focusing on the cases of science and scientific activity afforded by effective field theories, I'll try to sketch just such an argument for a philosophy of science, one that isn't realism—but isn't constructive empiricism either. I'll also try to utter at least one sentence about implications for what the metaphysics of science could or should be.

Dec 13

Simplicity of Fit: When and Why it Matters

Nina Emery (Holyoke)

Appeals to simplicity in philosophy of physics often involve what I call simplicity of fit. I argue that there are two distinct types of simplicity of fit, and illustrate the difference in terms of several ongoing debates about quantum ontology. I argue that these debates go astray in an important way when the interlocutors focus too much on one type of simplicity of fit.

Physical Grounding

Alastair Wilson (Leeds)

Naturalistic metaphysics looks to physics for guidance about fundamental reality. Uncontroversially, physics tells us about the material contents of the physical world. Can physics also tell us about relations of determination inherent in the physical world? I first look at two accounts of causation as physical, due to Dowe and Maudlin. I then turn to consider the prospect that physics might be able to offer an account of grounding (the non-causal yet objective explanatory determination of one fact by another) as likewise physical in nature. I disentangle some different questions about grounding which we might use physics to answer: the extensional question, the intensional question, and the hyperintensional question. I then sketch a naturalistic account of determination in the physical world which make use of a single primitive relation of objective explanatory determination - physical grounding - mediated by physical laws. Causation as modelled by Dowe and by Maudlin then turns out to be a special case of physical grounding: causing is, ultimately, a way of grounding. I close by offering some preliminary considerations from the debates over emergent spacetime and many-worlds quantum theory to support the physical grounding approach.