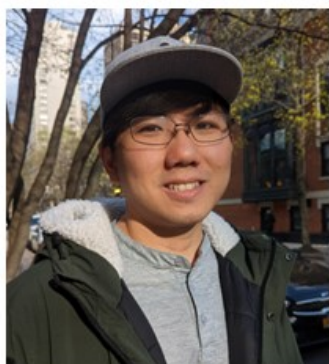


# Melting in Motion: On the Status of Classical Thermodynamics in Relativity

Wednesday, 9 October 2024, 4pm – 5.30pm

Venue: AS3-05-23

Relativistic thermodynamics is the task of rendering thermodynamics compatible with the principle of relativity; in special relativity this task is (in part) bound up with whether there are physically meaningful Lorentz transformations of thermodynamic laws and quantities, and in general relativity this task is (in part) bound up with whether there are physically meaningful thermodynamic laws and quantities even in accelerated frames. In this talk I will do two things. First, I introduce some of my recent works on the concept of temperature in special / general relativity, and the concept of pressure in special relativity. I argue that, on my proposed (necessary) condition of physical meaning which I call *consilience*, the physical meaning of the classical temperature and pressure breaks down in relativity, suggesting no natural successor to thermodynamic concepts in relativity. Second, I discuss the upshots of one particular interpretation of these results: (i) the application of thermodynamics requires a privileged time, that time along which systems (and their environment) are in equilibrium, (ii) contrary to standard discussions of thermodynamics and emergence, there is another 'thermodynamic limit' necessary for emergence, (iii) contrary to a mainstream view, symmetries need not track reality per se, only *fundamental* reality.



## Eugene Y. S. Chua

Eugene Y. S. Chua is a Nanyang Assistant Professor of Philosophy at NTU Singapore. Before NTU, he received his BA from Cambridge, obtained his PhD from University of California San Diego, and was an Ahmanson postdoc instructor at Caltech. He works on philosophy of physics, philosophy of science, and cognate metaphysical/epistemological issues, with special focus on the foundations of thermodynamics and spacetime. His paper on the relativistic temperature, "T Falls Apart: On the Status of Classical Temperature in Relativity", won the Mary B. Hesse Essay Prize at the 2022 PSA meeting.