AGPhil 1: Statistical Mechanics

Time: Monday 11:00–12:30 Location: H-HS III

AGPhil 1.1 Mon 11:00 H-HS III

The origins of observation — •Athamos Stradis — King's College London

In statistical mechanics, a system E at a given moment is described by a 'microstate', an exact microscopic configuration of its constituent particles. However, we only observe certain indistinguishable clusters of E's microstates ('familiar macrostates', $\{F_i\}$). Why do we observe *these* clusters, and not others ('alternative macrostates', $\{A_i\}$)? Some have offered an evolutionary explanation: since observing robust regularities is advantageous, and since $\{F_i\}$ exhibits such regularities (e.g. the Second Law), it*s no surprise that we observe $\{F_i\}$ rather than $\{A_i\}$.

To assess this explanation, we must interpret the word 'observe'. Understood passively as 'monitors', we monitor $\{F_i\}$ in that some of our states merely correlate with $\{F_i\}$. But my explanation undercuts the evolutionary explanation: since $\{F_i\}$ are the regular macrostates, they*re the ones involved in correlations, so how could we have monitored $\{F_i\}$ rather than $\{A_i\}$? One might argue that we don*t just monitor $\{F_i\}$, but also enlist them to guide our actions, and *this* is what evolution can explain. But my explanation undercuts even this: since enlisting $\{F_i\}$ presupposes monitoring $\{F_i\}$ via cognitive states in the first place, how could we have enlisted $\{F_i\}$ rather than $\{A_i\}$?

AGPhil 1.2 Mon 11:30 H-HS III

The time arrow in physics — •Grit Kalies — HTW University of Applied Sciences, Dresden, Germany

The experience of irreversibility, i.e. the empirical reality that processes have a direction and that yesterday can be distinguished from tomorrow, has occupied philosophers and physicists for centuries. Whereas quantum mechanics, special and general relativity etc. interpret processes as reversible, thermodynamics includes a physical term for the fact that a time arrow exists. This is called "The Paradox of Time" [1] that could not yet be explained by a physics approach.

In this paper is shown that the time paradox can be solved and the time arrow can be established in the whole of physics (nature), in full agreement with the experimental evidence. To this end, matter-energy equivalence [2,3] suggests abandoning the energetic idealizations of special relativity. This has far-reaching consequences for metaphysics in physics and fundamental concepts because special relativity and the associated idea of spacetime form a basis for the current standard models. The second law of thermodynamics can be understood as a fundamental law of nature, i.e. time symmetry is excluded [4].

[1] I. Prigogine, I. Stengers: Das Paradox der Zeit, Piper, München, Zürich, 1993. [2] G. Kalies: Matter-Energy Equivalence, Zeitschrift für Physikalische Chemie, 2019, DOI: 10.1515/zpch-2019-1487. [3] G. Kalies: Vom Energieinhalt ruhender Körper: Ein thermodynamisches Konzept von Materie und Zeit, De Gruyter, Berlin, 2019. [4] G. Kalies: A Solution of Time Paradox of Physics, International Journal of Theoretical Physics, 12/2019, submitted.

AGPhil 1.3 Mon 12:00 H-HS III

Deriving the local arrow of time — •Daniel Saudek — Frankfurt am Main, Germany

This contribution provides a derivation of time*s ordering properties, its metric properties, and its irreversibility on the basis of simple axioms. It does so in three steps: 1. It starts with the notion of the set of states of an object. There is a characteristic asymmetry on this set which can be defined independently of time, but which can be exploited to define temporal order (*before*) in a way which corresponds, as will be shown, with the order known from everyday experience. 2. The object is equipped with a counting mechanism based on successive inclusion, providing a natural parameter (as in Kuratowski*s construction of the naturals), which can then be fine-grained further to yield a rational and a real parameter. The local parameter so established is shown to increase monotonically with the before-ordering developed in (1). 3. It is shown that, given an object with a particular local index t (as developed under 2), the notion of changing the event content associated with indices less than t leads to a contradiction, whereas this is not true for indices greater than t. Thus, the local past is fixed, and the future open.