SISSA COLLOQUIUM

Elliott Lieb

SECOND THOUGHTS ON THE SECOND LAW OF THERMODYNAMICS

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The increase of entropy was regarded as perhaps the most perfect and unassailable law in physics and it was even supposed to have philosophical import. Einstein, like most physicists of his time, regarded the second law of thermodynamics as one of the major achievements of the field, and it entered his work in several ways. The essence of the second law is the statement that all processes can be quantified by an entropy function whose increase is a necessary and sufficient condition for a process to occur. As a fundamental physical law no deviation, however tiny, is permitted and its consequences are far-reaching. Current wisdom regards the second law as a consequence of statistical mechanics but the entropy principle, which was discovered before statistical mechanics was invented, ought to be derivable from a few logical principles without recourse to Carnot cycles, ideal gases and other assumptions about such things as 'heat', 'hot' and 'cold', 'temperature', 'reversible processes', etc. Like conservation of energy (the ``first" law), the existence of a law so precise and so model-independent must have a logical foundation that is independent of the details of the constitution of matter. In this lecture the foundations of the subject and the construction (with J. Yngvason) of entropy from a few simple principles will be presented.


credits: Chris Khamken

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Elliott Hershel Lieb is an American mathematical physicist and professor of mathematics and physics at Princeton University who specializes in statistical mechanics, condensed matter theory, and functional analysis. In particular, his scientific works pertain to: the quantum and classical many-body problem, the stability of matter, atomic structure, the theory of magnetism, and the Hubbard model. He is a prolific author in mathematics and physics with over 300 publications. He received his B.S. in physics from MIT (1953) and his Ph.D. in mathematical physics from the University of Birmingham in England (1956). Lieb was a (1956–1957) Fulbright Fellow at Kyoto University, Japan and for some time worked as the Staff Theoretical Physicist for IBM.

WHEN/WHERE

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