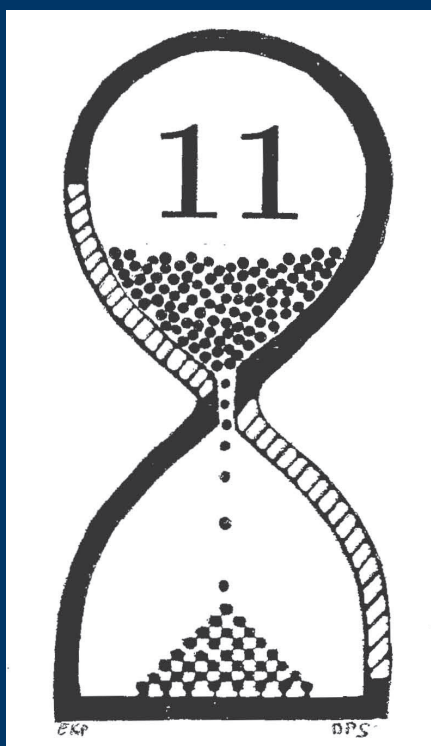


SECOND LAW OF THERMODYNAMICS: STATUS AND CHALLENGES

San Diego, California, USA 14 – 15 June 2011



EDITOR

Daniel P. Sheehan

AIP
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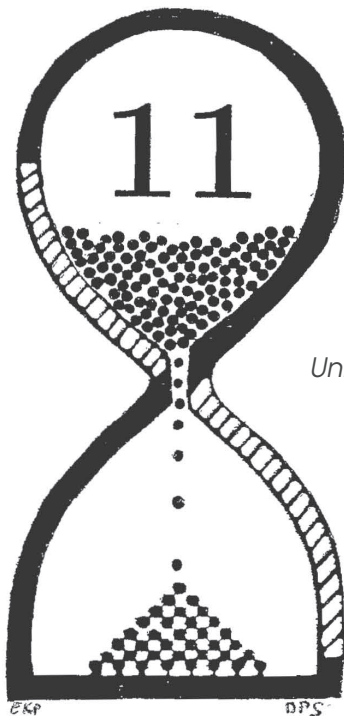
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PREFACE: SECOND LAW OF THERMODYNAMICS: STATUS AND CHALLENGES

No physical principle holds greater sway in the natural world than the second law of thermodynamics. It is widely regarded as the quintessential scientific truth, in large part because no exception to it has been recognized by the scientific community during its 150-year history.

Over the last 20 years, however, this situation has changed. More than two dozen challenges to it have entered the mainstream scientific literature, the majority of which remain unresolved [1]. Their physical regimes are wide-ranging: from absolute zero up to the melting point of refractory metals; from the nanoscopic to the planetary; from the classical to the quantum mechanical. Most involve physical processes or conditions inaccessible or unknown at the time the second law was formalized. Several are currently undergoing laboratory test.

Second Law of Thermodynamics: Status and Challenges (SL2011) is the third in a series of international meetings at University of San Diego devoted to the emerging field of second law challenges. In 2002, *Quantum Limits to the Second Law: Theory and Experiment* represented the first international conference on the subject [2], followed in 2006 by *Second Law of Thermodynamics: Foundations and Status*, which was convened under the auspices of the Pacific Division of the American Association for the Advancement of Science (AAAS-PD) [3].

SL2011 continued the tradition of its predecessors, fostering conversations from all sides of the second law debate. Roughly half the presentations explored developments in classical and quantum statistical mechanics and thermodynamics; the remainder represented theoretical and experimental challenges. The discussions at the symposium were lively, collegial, and open-minded.

Competitions are most exciting when the stakes are high and the competitors evenly matched. After 150 years of preeminence, the second law finds itself in such a contest, where challenges have put its absolute status at risk. The outcome is uncertain, but for the first time it plays in an 'evenly split game.' That is, the second law is in a *jeu parti*: it is in *jeopardy*.

Daniel P. Sheehan
University of San Diego
September, 2011

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