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Research on Student Learning of Upper-Level Thermal and Statistical Physics¹

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Within the last decade, physics education researchers have begun to extend the tools and methods used at the introductory level to conduct systematic investigations of student learning of thermal and statistical physics in the upper division. Most research in thermodynamics has focused on student ideas about the first and second laws and the associated concepts (e.g., work, heat, entropy). Several studies yield insights about broader ideas, such as state functions. Research in statistical physics has focused on the concepts underlying multiplicity and related ideas in probability. Research has identified a number of conceptual difficulties with varied degrees of persistence, some of which are consistent with findings at the introductory level. Some investigations further probe connections between physics and relevant mathematics concepts in these areas, including student interpretation of canonical representations such as pressure-volume (P-V) diagrams. Results from research are guiding the development of curricular materials in order to address several known difficulties.

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