

WOMEN IN ASTRONOMY AND PHYSICS LECTURE SERIES



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Comparing two identical systems in their relaxation to the environment, we expect that the system with a smaller mismatch between its and the environment's temperature will thermalize faster -- yet it is not always the case. The Mpemba effect is an example of an anomalous relaxation process, where "hot cools down faster than cold" or "cold heads up faster than warm." The effect was experimentally observed in water, magnetic systems, clathrate hydrates, polymers, and colloidal particle systems. It was simulated in granular fluids, spin-glasses, driven gasses, quantum systems, magnetic alloys, and gases without equipartition. The numerous occurrences of the effect imply that it is general. To understand the general nature of the Mpemba effect, we theoretically study a model system -- the overdamped dynamics of a particle moving on a potential surface. We connect the occurrence of the Mpemba effect with the properties of the potential, characteristics of its meta-stable states, and provide further insight into anomalous relaxation processes.

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