18[èmes] Journées de la Matière Condensée
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Société Française de Physique

"*Caloric Effects for Energy Conversion: from ferroïc transitions to heat-pumps*"

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2. **Parrainage ou lien avec des sociétés savantes, des GDR ou autres structures :**

3. **Résumé de la thématique** du **minicolloque :** Since the report of Giant Magnetocaloric Effect in GdSiGe alloys [1] the opportunity of developing novel solid-state cooling-devices using a magnetocaloric material as active substance unleashed an unprecedented interest in first-order magnetic transitions. Driven by the need for understanding the underling physics, for tailoring transition properties, and for discovering new alloys showing magnetic and magneto-structural transitions with a huge thermal response, the number of publications per years on this topic got up to 800 in 2019 [2 - 4]. A further widening of the research scope has been triggered by a growing attention towards similar caloric effects taking place in electrocaloric, and mechanocaloric systems on the verge of a ferroïc transition [5, 6]. As it often happens when a topic is addressed by a huge and heterogeneous community, spanning from electrical and material engineers, to condensed matter, and theoretical physicists, conferences and publications got splitting into sub-topics seldom communicating between them. Beyond the traditional materials vs. devices opposition, a further gap often arises between scientists focusing on *ab initio* works on the one side [7], and critical exponent oriented [8], or Ginzburg - Landau approaches on the other [9]. In spite of a growing number of publications aiming to plug the gap between material-modeling and applications [10, 11], the caloric materials community is still pretty disunited, and suffers of the lack of interchange between its many branches. This is the main challenge this *colloquium* aim to address: bringing together scientist working on different materials (from magnetic alloys, to ferroelectric polymers), and from different perspectives (from first-principle calculations, to thermodynamic, from material production and characterization to their deploying into devices), and fostering discussion and mutual exchanges.

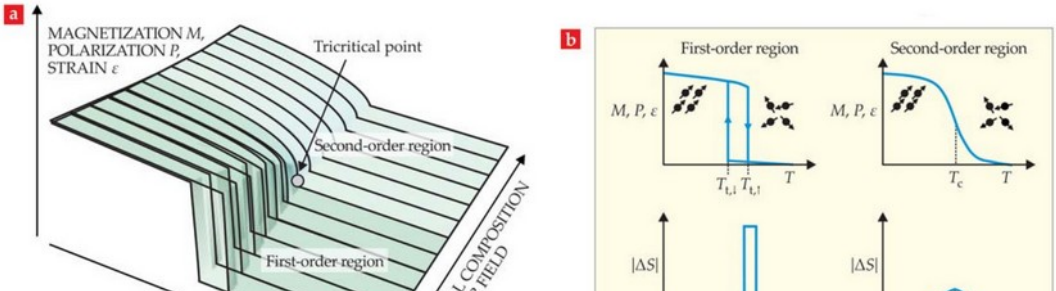

Figure from [3]. Schematic of a ferroïc coolant's behavior with phase transition as a function of temperature. (a) The change from first- to second-order behavior, through a tricritical point, may be induced by a change of composition or applied field. (b) A first-order transition (left panels) results in a larger transition entropy change ΔS than in the second-order case (right panels), albeit over a narrower temperature window. Tt,↓ and Tt,↑ are transition temperatures for decreasing and increasing T respectively. Thermal hysteresis is clearly present in the first-order case.

Références

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