Spin glass states in quasicrystals and quasicrystal approximants

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Spin glass (SGs) states have been observed in a wide variety of materials, from intermetallic alloys to bulk oxides and nanoparticle systems [1]. SGs are characterized by their unique dynamical magnetic properties, which include aging, memory, and rejuvenation features [1]. SG behavior usually stems from the random mixture of magnetic interaction, yielding magnetic frustration. It is also observed in geometrically frustrated systems [1]. In this context, quasicrystals (QCs) and approximant crystals (ACs) provide a new playground for studying magnetic frustration, owing to their unconventional crystal and magnetic structures [2].

Quasicrystals and quasicrystal approximants have similar local atomic arrangements, albeit the latter are periodic crystals. The dynamical magnetic properties of Tsai-type icosahedral quasicrystals (i-QCs) and approximant crystals have recently been investigated by means of magnetometry [3-5]. Those systems are intermetallics including a magnetic lanthanide such as Gd or Tb. In this presentation, the magnetic properties of i-R-Cd QCs and R-Au-Si ACs (R: lanthanide) will first be reviewed. The dynamical magnetic properties of i-Gd-Cd [3] and i-Tb-Cd QCs [5] and Tb-Au-Si ACs [4] will be presented and discussed in more detail, and compared to those of archetypal SGs. Interestingly, the glassy properties of the investigated QCs and ACs show common features, suggesting a similar type of magnetic frustration in those systems.

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References

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