High-$T_c$ superconducting state of metal nanoclusters: Experimental observation

VITALY KRESIN, AVIK HALDER, University of Southern California — A spectroscopic investigation of size-resolved aluminum nanoclusters, Al$_n$, has revealed a novel phenomenon: a rapid rise in the near-threshold density of states of several specific clusters with decreasing temperature. The effect is especially prominent in the closed-shell “magic” cluster Al$_{66}$. The characteristics of this behavior are fully consistent with a pairing transition, implying a high-temperature superconducting state with $T_c >\sim 100$ K. This value exceeds that of bulk aluminum by two orders of magnitude. This is the first experimental observation of high-temperature superconductivity in nanocluster particles. Our results highlight the promise of metal nanoclusters as high-$T_c$ building blocks for materials and networks.

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Vitaly Kresin
University of Southern California

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