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Quantized Ferromagnetism in Free Cobalt and Iron Clusters XIAOSHAN XU, SHUANGYE YIN, RAMIRO MORO, ANTHONY LIANG, JOHN BOWLAN, WALT A. DE HEER, Georgia Institute of Technology — The magnetic moments μ_N for cobalt clusters Co_N ($20 \leq N \leq 200$) measured in a cryogenic molecular beam are found to be quantized both in the ground state: $\mu_N \sim 2N_B$ and in the metastable excited state: $\mu_N^* \sim N\mu_B$ in contrast with the bulk where it is fractional: $\mu_{N=\infty}=1.7N\mu_B$. For N=30, the ionization potentials of the excited state is about 0.1 eV lower than of the ground state while this difference diminishes with increasing size, which implies that the two states become degenerate at large sizes. The evolution from localized moments in small clusters to itinerant moments in the bulk appears to be related to the closing of this energy gap which results in a fluctuating ground state. These effects can be understood in terms of the Falicov-Kimball model. Two states are also observed in iron clusters, with $\mu_N \sim 3N\mu_B$ for Fe_N, and $\mu_N^* \sim N\mu_B$ for Fe_N^* ($20 \leq N \leq 150$).

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