



## **Physics Colloquium**

Friday, November 19, 2010, 4:00 pm, PS 3046

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### *Heterogeneous Nucleation in the Ising Model*

In simulations of the 2D Ising model, we examine heterogeneous nucleation on a microscopic impurity. The impurity consists of  $w$  sites with spins fixed to the value of the stable phase, arranged in either a line or a square. We focus on impurities for which  $w$  is smaller than the number of sites in the critical nucleus for homogeneous nucleation. We evaluate the nucleation time  $\tau$ , the free energy barrier for nucleation  $\Delta G^*$  and the size of the critical nucleus  $n^*$  as a function of  $w$ , and compare the results to those for homogeneous nucleation. As  $w$  increases toward a critical value  $w_c$ , the barrier for heterogeneous nucleation disappears, and the metastable state ceases to be well-defined. For both line and square impurities, we find that the value of  $w_c$  is significantly less than  $n^*$  due to wetting of the impurity by the stable phase. We also find that line and square impurities having the same surface area, regardless of  $w$ , produce the same values of  $\Delta G^*$ ,  $\tau$  and  $n^*$ .