## A FIRST-PRINCIPLES ISING MODEL

 $\hat{S}_i$  (+1 if occupied by B,-1 if occupied by A), we define for each figure f in configuration  $\sigma$  the spin product  $\Pi_f(\sigma) = \hat{S}_1, \hat{S}_2, \dots \hat{S}_{k_f}$ . The energy  $E(\sigma)$  of any lattice configuration can then be rigorously expanded<sup>7</sup> into an Ising-like series where the "lattice averaged products"  $\overline{\Pi}_F(\sigma)$  are  $\sum_{\Re} \prod_{\Re F}(\sigma) / Ng_0$  and  $Ng_0$  is the number of operation  $\Re$ 

in the space group of the lattice.

While the cluster expansion of Eq.(3) is exact, its

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