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In a joint work of W. Holsztyński and the author a criterium of the existence of phase transitions in ferromagnetic spin systems at low temperatures has been given. It involves properties of an algebra canonically associated with any such system:

Let $\mathbb{F}_2[\mathbb{Z}^\nu]$ be the group algebra of the group $\mathbb{Z}^\nu$ of translations with coefficients in the two-element field $\mathbb{F}_2 = \{0,1\}$; with a ferromagnetic interaction J one associates an ideal $\bar{B}(J)$ of $\mathbb{F}_2[\mathbb{Z}^\nu]$. It then appears that <u>if this ideal is not a principal one the system exhibits phase transitions at low enough temperatures</u>.

As far as the calculations are concerned, to apply this criterium one has to find the greatest common divisor of few polynomials (with coefficients in $\mathbb{F}_2$) and to find out if this g.c.d. belongs to $\bar{B}(J)$. This is a rather easy task.

The criterium can be developped into a method of calculation of all ergodic equilibrium states at low temperatures. One then easily produces examples of models with a large number of ergodic equilibrium states and with varying mixing properties.

The details and a number of examples can be found in:

[1] W. Holsztyński, J. Slawny, Phases of Ferromagnetic Spin Systems at Low Temperatures, Lett. N.C. 1975.

[2] W. Holsztyński, J. Slawny, In preparation.

[3] J. Slawny, Ferromagnetic Spin Systems at Low Temperature, to appear in Commun. Math. Phys.

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