

[tex174] **Order parameter of first-order Ginzburg-Landau transition**

The Ginzburg-Landau expression for the Helmholtz free energy of system undergoin a first-order transition reads

$$A(T, M) = \alpha_0(T) + \alpha_2(T)M^2 + \alpha_4(T)M^4 + \alpha_6(T)M^6,$$
$$\alpha_2(T) = \beta_2(T - T_0), \quad \alpha_4(T) < 0, \quad \alpha_6(T) > 0.$$

- (a) At the critical temperature  $T_c$ , the dependence of  $A$  on  $M$  has degenerate minima at  $M = 0$  and  $M = \pm M_c$ . Find  $T_c$  and  $M_c$ .
- (b) Show that the extremum at  $M_s = 0$  of  $A$  is a minimum at  $T > T_0$ .
- (c) Find location  $M_s \neq 0$  of the other extremum of  $A$  and determine the range of  $T$  for which it is a minimum.

**Solution:**