$n = 0$ and (5). The statement (5) about the linear nature of Zeno-states is far from trivial. Indeed the expression for Z, which for the system with binary potential interaction $\Phi(r_{12})$ reads as (see e.g. [2]):

$$Z = \frac{P}{n\,T} = 1 - \frac{2\pi\, n}{3\,T} \int r^3 \frac{\partial\, \Phi(r)}{\partial\, r}\, g_2(r; n, T)\, d\, r\,, \tag{7}$$

where g_2 is the pair correlation function. Therefore the linearity of the Zeno states is due to quite specific structure of the dependence of correlation function $g_2(r; T, n)$ on the thermodynamic state.

Below, following the arguments of previous work [15], we show that these facts can be casted into elegant geometrical formulation and expand them into general case of the short range power-like attractive potentials in d dimensions. We show that the locus of the CP can be estimated using the correspondence between the scaling properties of the Hamiltonians for the lattice gas and the fluids with the power-like interactive potentials.

THE ZENO-LINE AND THE GLOBAL ISOMORPHISM

As was shown in [15] the linearities of (2) and (5) can be derived on the basis of the assumption of the existence of the global isomorphism of the real liquid-gas part of the phase diagram of the lattice gas model. Note that the line $x = 1$ of the LG can be thought of as the analog of the Zeno-line. Indeed the pair correlation function $g_2(r)$ of the LG vanishes identically for such "holeless" states according to the definition. The same is true for the state with empty sites $x = 0$. Thus the line $x = 0$ can be identified with the zeroth density axes $n = 0$ of the real fluid, while the line $x = 1$, obviously, can be identified with the Zeno-line $Z = 1$. To conserve the linearity and the adjacency properties of the characteristic elements the isomorphism between LG and the fluid should be chosen in the class of the projective mappings [16] and has the form:

$$n = \; n_b\, \frac{x}{1 + z\, t}\,, \quad T = \, T_Z\, \frac{z\, t}{1 + z\, t}\,, \tag{8}$$

where

$$z = \frac{T_c}{T_Z - T_c}\,. \tag{9}$$

The coordinates of the CP for the liquid are:

$$n_c = \frac{n_b}{2\,(\,1 + z\,)}\,, \quad T_c = T_Z\, \frac{z}{1 + z}\,, \tag{10}$$