1064-82-388 **Tian Ma**, Chendgu, Sichuan , Peoples Rep of China, and **Shouhong Wang***
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Gas-liquid transition is one of the most basic problem to study in equilibrium phase transitions. In the pressure-temperature phase diagram, the gas-liquid coexistence curve terminates at a critical point C, also called the Andrews critical point. It is, however, still an open question why the Andrews critical point exists and what is the order of transition going beyond this critical point. To answer this basic question, using the Landau's mean field theory and the Le Chatelier principle, for the first time, a dynamic model for the gas-liquid phase transitions in a PVT system is established. With this dynamic model, we are able to derive a theory on the Andrews critical point C: 1) the critical point is a switching point where the phase transition changes from the first order with latent heat to the third order, and 2) the liquid-gas phase transition going beyond Andrews point is of the third order. This clearly explains why it is hard to observe the liquid-gas phase transition going beyond the Andrews point. In addition, the study suggest an asymmetry principle of fluctuations, which appears also in phase transitions in ferromagnetic systems. This example demonstrates a symbiotic interplay between advanced mathematics and nonlinear sciences. (Received September 14, 2010)