What is critical fluctuation of liquid-liquid phase transition ?
- What a comparison of water and tellurium reveals -

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Liquid water near ambient conditions is known to exhibit many thermodynamic anomalies. A few scenarios have been proposed, of which the liquid-liquid phase transition (LLT) scenario is considered the most promising [1]. This LLT scenario has been strongly supported by recent dynamic fluctuation measurement using sound wave [2]: Dynamic fluctuation associated with LLT exist over a very wide temperature and pressure ranges and is found for the first time to be linked with change in the isochoric specific heat. On the other hand, the significant change in static density fluctuation observed by small-angle scattering (SAS) method is limited to the supercooled region [3], revealing the difference between the dynamic and static fluctuations.

In discussing this, we focus on liquid tellurium, which exhibits thermodynamic anomalies similar to those of water: A scenario assuming mesoscopic inhomogeneity associated with LLT has been proposed as a comprehensive model to explain thermodynamic anomalies [4]; Dynamic fluctuation has been observed over a very wide temperature range [5], while the effect of static density fluctuation is limited to the supercooled region [6,7]; those are the same as the case of water. Although water and tellurium are completely different material systems, commonalities do exist: Experimental results indicate that both liquid water and tellurium are in a mixture of two electronic states [8,9]. In other words, LLT critical fluctuation may not be a simple two-fluid density state, but also a two-fluid electronic state ? SAS detects only the former, but sound wave detects both, which makes difference.

In this poster, we will discuss the nature of critical fluctuation of LLT while presenting various data showing the commonalities between liquid water and tellurium.

REFERENCES

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