Contribution ID: **264** Type: **Talk (25 + 5 min)**

Dynamic criticality of a 3d- and 2d-Ising system made of 3-picolin/D_2O and antagonistic salt

Wednesday, March 22, 2023 2:00 PM (30 minutes)

After the static criticality of 3-picolin/D_2O and 3-picolin/D_2O/sodium tetraphenylborate having been identified to be of the 3d-Ising and 2d-Ising type, respectively, we investigated the dynamic criticality of the two systems using dynamic light scattering and neutron spin-echo spectroscopy. The first method yields the hydrodynamic diffusivity, while the second method observes the dynamics of the critical fluctuations. The experimental data could be interpreted in terms of the crossover function of Kawasaki with slight modifications [1], yielding a dynamic critical exponent z of 0.06 for the first system and $z \approx 0$ for the second system. The result for the first system agrees with the measured critical exponent of the viscosity $x = 0.04$ and $z = x/\nu$ ($\nu = 0.63$). The result $z \approx 0$ for the second system appears consistent with the critical exponent of the heat capacity in two dimensions [2] being zero. The observation of rather undisturbed classical random walk diffusion in the 2d-Ising system contradicts the Pomeau divergence [3] that would predict a completely different diffusion behavior at larger times [4]. We believe that the wave fronts of the charge density waves of the antagonistic salt, that take place at very large wavelengths, confine the spatial extent of the 3-picolin/D_2O composition fluctuations. However, this is not a very strict confinement and so the system can enter the third dimension at a typical breakout time that we would connect to the charge density waves of the system (observed by DLS). We present this paper as a combination of SAXS, SANS, DLS, NSE and viscosity measurements. To our knowledge this is the first time that dynamic criticality in a 2d-Ising system has been observed experimentally.

[1] Burstyn, H. C., Sengers, J. V., Bhattacharjee, J. K., and Ferrell, R. A. (1983). Dynamic scaling function for critical fluctuations in classical fluids. Physical Review A, 28(3), 1567.
[2] Anisimov, M. A. (2011). Fifty years of breakthrough discoveries in fluid criticality. International Journal of Thermophysics, 32(10), 2001-2009.
[3] Pomeau, Y. (1972). Low-frequency behavior of transport coefficients in fluids. Physical Review A, 5(6), 2569.
[4] Liu, B., Goree, J., and Vaulina, O. S. (2006). Test of the Stokes-Einstein relation in a two-dimensional Yukawa liquid. Physical Review Letters, 96(1), 015005.

Authors: DUBEY, Purushottam (JCNS - 4); ZHENG, Feifei (Technische Universtität München); Dr SHIN, Eunjoo (Korea Atomic Energy Research Institute); Dr ODOM, Mary (Oak Ridge National Laboratory); ZOLNIERCZUK, Piotr (Oak Ridge National Laboratory); Dr WU, Baohu (JCNS-MLZ, FZ Juelich); HOLDERER, Olaf; Prof. SENGERS, Jan V. (U of Maryland); FRIELINGHAUS, Henrich (JCNS)

Presenter: FRIELINGHAUS, Henrich (JCNS)

Session Classification: Polymers and Criticality

Track Classification: Soft Condensed Matter