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The Widom line and noise power spectral analysis of a supercritical fluid[1] SUNGHO HAN, CLARE YU, Department of Physics and Astronomy, University of California, Irvine — In a typical pressure-temperature phase diagram for a fluid, there is a first order phase transition line between the liquid and the vapor phases that terminates at a critical point. Beyond this critical point lies the supercritical regime where one can go continuously between the liquid and vapor phases. In the supercritical region, there is a line of specific heat maxima, called the Widom line, which is often regarded as an extension of the liquid-vapor coexistence line. Using molecular dynamics simulations of a Lennard-Jones fluid, we find that the noise power spectrum of the density fluctuations on the Widom line of the liquid-vapor transition can be divided into 3 frequency regions. The intermediate frequency region with 1/f noise appears as the temperature approaches the Widom temperature from above or below. Furthermore, we find that the power spectra of both the density and potential energy fluctuations at low frequency have a maximum on the Widom line, suggesting that the noise power can provide an alternative signature of the Widom line.

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