Coulon *et al.* Reply: In a recent Letter [1], experimental evidence for a second-order symmetric-asymmetric (S-A) phase transition in a system of randomly connected membranes (sponge phase) was given. Static light scattering was used to obtain the density correlation function $S(q)=\langle|\rho_q|^2\rangle$. The experimental results were fitted using a theoretical expression of $S(q)$ derived from a Gaussian theory [2,3] which takes into account the coupling between the density order parameter ρ and η, the order parameter of the S-A broken symmetry.

There are, in fact, two separate levels at which the new data presented in Ref. [1] support the proposal of a line of second-order phase transitions from a symmetric to an asymmetric sponge state. First, the scattering data on the symmetric side, not too close to the transition line, are well fitted by the unusual inverse tangent scattering function derived in Refs. [2,3] which specifically depends on the existence of two order parameters. Second, there is a clear divergence seen in both the scattering $S(q=0)$ and the correlation length of the η fluctuations, ξ_η, not just at a single point on the phase diagram but along a line. Just such a line of second-order phase transitions was earlier predicted theoretically [2–4]. In fact, the analysis of the divergence of $S(0)$ against $\rho-\rho_c$ using a power law gives a critical exponent close to 0.5.

Pfeuty's Comment [5] concerns only the interpretation of the measured critical exponent. While we agree that the argument given in Ref. [1] for the *value* of this exponent is not completely correct, we emphasize that the existence of a line of divergence in $S(0)$ and the unusual form for the observed scattering function remain compelling evidence for the overall scenario of an A-S sponge transition. Pfeuty's own explanation of the exponent 0.5, which he argues [5] is a signal of *tricritical fluctuations,* does not contradict, but rather reinforces this interpretation: Without a second (hidden) order parameter, and a resulting line of second-order transitions, there would be no reason to expect a tricritical point in this system.

In fact, we are not at all sure that Pfeuty's interpretation of the exponent is correct. First, the Gaussian fluctuation calculation of the scattering function (Ref. [2]) should not only apply near the tricritical point but also on approaching the second-order line, so long as one remains outside the Ginzburg interval. Experimental observation of the exponent 0.5 that this theory predicts could be interpreted either in terms of a narrow critical interval, or in terms of proximity to a tricritical point: Both statements are equivalent in saying that quartic terms can be neglected in practice.

However, there is a serious problem with this interpretation which concerns Fisher renormalization of the exponents [6]. In the system under study, there are two densities. One can define a linear combination of these densities, variation of which corresponds to approaching the second-order line at right angles. (This is equivalent to the order parameter ρ used in Ref. [2].) Fisher renormalization will occur if the density ρ is used as a control parameter to approach the transition. Indeed, close to the tricritical point it can be confirmed explicitly from the model of Ref. [2] that $\rho-\rho_c$ varies as $(\mu-\mu_c)^{1/2}$, which leads to a Fisher renormalization of the exponents when the transition is approached by varying the composition of the system rather than chemical potentials. Close enough to the tricritical point, the expected divergence of $S(0)$ is therefore characterized [6] by an exponent 1, rather than $\frac{1}{2}$ as proposed by Pfeuty. We do not know of an argument that should prevent this shift in exponent being observable in the system studied in Ref. [1].

Very close to the second-order line, $S(0)$ continues to diverge like the energy-energy correlation function, as Pfeuty correctly observes [6], and therefore the estimate 0.58 for the exponent given in Ref. [1] (see also Ref. [7]), based on an inappropriate use of a decoupling approximation, is not valid [8]. Without Fisher renormalization, the correct exponent is $\alpha=0.1$, much smaller than the observed value; when the renormalization effect is included, we find the exponent $\alpha/(1-\alpha)$, again close to 0.1.

We conclude that Pfeuty's interpretation of the observed exponent close to 0.5 is sustainable only if, for some reason, Fisher renormalization does not arise over the range of the experimental measurements. This is quite possible, since the renormalization effect only sets in "close" to the transition [6]. An alternative explanation of the observed value of 0.5–0.6 is that the experimental systems are close but not very close to the tricritical point, and that the observed exponent reflects a slow crossover from the value of 0.1 expected on the second-order line, to the value 1 expected at the tricritical point, when Fisher renormalization is taken into account.

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Received 21 June 1991
PACS numbers: 64.70.Ja, 64.60.Fr, 78.35.+c

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[8] We thank S. Ramaswamy for a careful discussion of this point.