present. The authors illustrated this point nicely by comparing an edge defined by electrostatic gating (which corresponds to a shallow confinement potential) and an edge defined by etching (which corresponds to a steep confinement potential). One would expect that the steeper the confinement potential, the narrower the compressible and incompressible stripes, down to the limit where their extent reaches the magnetic length. At this point incompressible stripes can no longer insulate between neighbouring compressible stripes, and the edge reconstruction collapses.

This is what Venkatachalam *et al.*[2] observed for a magnetic field of $B = 6.2$ T ($\nu = 1$): whereas the shallow potential supports an edge reconstruction and heat is transported upstream, the steep confining potential does not support a reconstruction, and no heat is transported upstream. However, when $B = 8.3$ T (still $\nu = 1$, but at the high-magnetic-field end of the plateau) the edge reconstruction seems to survive even for the steep potential, possibly due to the fact that the inner incompressible stripe on the plateau extends more into the bulk at higher magnetic fields. Therefore, upstream heat transport could be observed. This would also reconcile their estimate of the width of the edge reconstruction of several micrometres at 8.3 T with the recently reported much smaller values at the centre of the plateau[14]. Venkatachalam and co-workers emphasize that heat transport could therefore point out the differences in edge reconstruction, even in situations in which charge transport measurements give identical results.

These results are an important piece of the puzzle in our understanding of the fractional QH effect in general and the edge reconstruction in particular. Progress in this field might bring us closer to quantum computers working in the $\nu = 5/2$ QH regime. Furthermore, the role of neutral modes in quantum interferometry is still unclear, but this knowledge may be the key to the implementation of fractional quasiparticle Mach–Zehnder interferometers, currently one of the main goals in the field of coherent quantum transport. ❐

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References

1. Von Klitzing, K., Dorda, G. & Pepper, M. *Phys. Rev. Lett.* **45,** 494–497 (1980).
2. Venkatachalam, V., Hart, S., Pfeiffer, L., West, K. & Yacoby, A. *Nature Phys.* **8,** 676–681 (2012).
3. Halperin, B. I. *Phys. Rev. B* **25,** 2185– 2190 (1982).
4. Chklowskii, D. B., Shklovskii, B. I. & Glazman, L. I. *Phys. Rev. B* **46,** 4026–4014 (1992).
5. Tsui, D. C., Störmer, H. L. & Gossard, A. C. *Phys. Rev. Lett.* **48,** 1559–1562 (1982).
6. Ji, Y. *et al. Nature* **422,** 415– 417 (2003).
7. Altimiras, C. *et al. Nature Phys.* **6,** 34–39 (2010).
8. Kouwenhoven, L. P. *et al. Phys. Rev. Lett.* **64,** 685–688 (1990).
9. Roddaro, S. *et al. Phys. Rev. Lett.* **95,** 156804 (2005).
10. MacDonald, A. H. *Phys. Rev. Lett.* **64,** 220–223 (1990).
11. Kane, C. L., Fisher, M. P. A. & Polchinski, J. *Phys. Rev. Lett.* **72,** 4129–4132 (1994).
12. Bid, A. *et al. Nature* **466,** 585–590 (2010).
13. Gurman, I., Sabo, R., Heiblum, M., Umansky, V. & Mahalu, D. Preprint at https://arXiv.org/abs/1205.2945 (2012).
14. Paradiso, N. *et al. Phys. Rev. Lett.* **108,** 246801 (2012).

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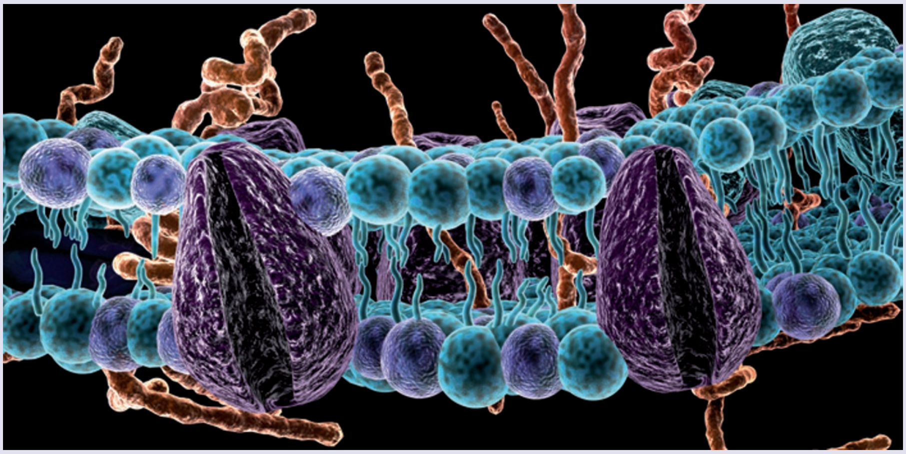
CASIMIR EFFECT

Across a crowded membrane

Hendrik Casimir's 1948 prediction of fluctuation-induced forces is famously associated with the classical example of two charge-neutral conducting plates in a vacuum, mutually attracted due to the constraints they impose on the quantum fluctuations of the electromagnetic field. But Casimir's interest in the problem originally stemmed from his work on colloidal solutions — and its most recent application doesn't stray far from this soft-matter theme. Benjamin Machta and colleagues have identified a role for Casimir forces in the plasma membrane of the mammalian cell (illustrated in the computer-generated image below), in which the relevant fluctuations are not quantum mechanical, but compositional, in origin (*Phys. Rev. Lett.* (in the press); preprint at http://arXiv.org/abs/1203.2199; 2012).

Cell membranes are two-dimensional liquids comprising thousands of proteins that form structures varying dramatically in size — some up to a hundred times the size of the proteins themselves. Energy estimates suggest that maintaining this heterogeneity comes at a hefty cost, so one might well wonder what the membrane gains in return.



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Some indication came with the results of experiments suggesting that membranes exist in close proximity to a miscibility critical point in the two-dimensional universality class — but the payoff was still unclear. Now, Machta *et al.* have shown, using conformal field theory and Monte Carlo simulations, that the fluctuations in membrane composition associated with this criticality are capable of mediating long-range Casimir forces between membrane-bound proteins.

The idea is that near a miscibility critical point, small free-energy differences between clustered and unclustered states might allow the cell to control the spatial organization of the membrane more easily. And this gives the membrane good reason to retain its costly heterogeneity. Key binding events during the process of signal transduction within the membrane often involve large-scale spatial reorganization. Perturbations to composition that disrupt this reorganization are known to affect signalling. The results of the study by Machta *et al.* indicate that such disruptions might act to distance the membrane from its critical point, thus interfering with the associated Casimir forces.

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