coherence time in this system was shown to be longer than the single polariton lifetime, so the observed multiple condensates remain coherent. As a result, a macroscopic quantum harmonic oscillator or pendulum was realized.

In the time domain, the condensate was found to oscillate in the trap with a terahertz frequency, which could be tuned by changing the spacing between the pump spots. Comparison of the experimental data with a theoretical model based on the complex Ginzburg-Landau equation enabled the researchers to conclude that the condensates that occupied different quantum states of the 'pendulum' were mutually coherent. They argue that the energy-conserving polariton-polariton scattering populates the ladder of confined states with exciton polaritons that are correlated in phase. Moreover, the authors suggest that this scattering, which is efficient only if the involved initial and final states are separated by equal energy intervals, is responsible for formation of the parabolic confining potential. This still needs verification, as it looks like the parabolic confining potential is governed by the

strongly populated exciton reservoir rather than by the polariton condensate.

The experiments on polariton condensation at non-resonant optical pumping present a challenge to theorists. The description of an incoherent reservoir of optically pumped polaritons together with a coherent condensate fed by this reservoir is not a straightforward task. As an essentially non-equilibrium system, microcavities with polariton condensates seem to require a theoretical treatment going beyond the mean-field approximation. In my view, a nonlinear Liouville equation applied to the density matrix of the whole system would be an adequate theoretical tool.

The experiment opens a way towards engineering polariton condensates by optical means. Manipulation of bosonic particles with macroscopic coherent states is crucial for realizing optical logic elements such as polariton neurons⁹ or Aharonov–Bohm rings¹⁰. Also, bosonic transport of exciton polaritons is a new and promising direction for polaritonics. When moving in the plane of the microcavity by fractions of a millimetre, the polaritons conserve their coherence and polarization; this is important for realizing spin–optronic devices based on bosonic spin currents. To this end, it would be interesting to repeat the experiment while varying the polarization of the pump light in an attempt to create spin-selective polariton traps.

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INNOVATION ADOPTION

The coming of Twitter

"Tell me when you started tweeting, and I'll tell you who you are." Jameson Toole, Meeyoung Cha and Marta González don't go quite that far in their conclusions, but their study of when and where people signed up to the microblogging platform Twitter provides a wealth of information about the process of social contagion and technology adoption (*PLoS ONE* 7, e29528; 2012). In particular, they find quantitative evidence that for 'early adopters' geographic location was a key factor to reach a critical mass, whereas at later stages the influence of mass media took over.

Toole *et al.* looked at Twitter's week-byweek user gains between early 2006 and late 2009. From the data, they identified the 408 locations in the United States where more than 1,000 users had signed up during the first three-and-a-half years of Twitter's existence. The Twitter history of each of these places was distinctly different. The first hotspots were, not surprisingly, close to Silicon Valley and in college towns around the United States — places with a young, tech-savvy population. During this early phase, old-fashioned word-of-mouth



recommendation within local networks seems to have been mainly responsible for the growing user base.

Later, the Twitter 'virus' spread to major metropolitan areas, and then on to more rural and remote locations. Then another factor came into play: mass media. To measure the effect, Toole *et al.* drew on data from Google, capturing the relevant news and search volumes. They found, in Twitter's early life, a direct correlation between the number of Twitter sign-ups and the number of search queries and news reports on Google. But some 120 weeks after the launch, the rate of user gain became super-linear. By that time, celebrity endorsements and reports of Twitter's role in the organization of demonstrations and revolutions had created a kind of feedback loop — with the media reporting on the increasing adoption of tweeting while themselves driving it. Toole *et al.* estimate that mass media has been responsible for a growth of the Twitter user base by a factor of two to four.

This work extends the existing body of literature on the diffusion of innovations, although the case of Twitter may be a special one, as the service comes free of cost and with little risk. How the particular interplay between geographic and media influences captured in this model may relate to the adoption of other innovations and technologies remains to be seen. But the study highlights that traditional contagion and diffusions models need amendment if they are to capture processes on modern information networks.

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