Comment on "Room Temperature Electrically Injected Polariton Laser"

In a recent paper, Bhattacharya and co-workers [1] claim the observation of an electrically driven room-temperature polariton laser. This is an outstanding claim. The technological solution proposed in Ref. [1] looks very interesting, and merits our close inspection. Contrary to the standard structure for polariton lasing [2,3], where a planar microcavity is excited through the distributed Bragg reflector mirrors (DBR) [4], here the basis of the structure is a conventional planar *p-n* junction. The cavity is first obtained by lateral etching, the two DBRs being evaporated on both sides of this etching to finalize the device.

In this Comment I challenge the main conclusions of Ref. [1]. The main reason for this Comment is the large number of questions on the details of the experiment that led me to request the raw data. I have obtained two sets of raw data. After a long discussion with the authors and the editors of PRL we decided that I should use the second set of data. Within the limited space of a Comment, I will only discuss here two of the published figures.

In Fig. 1(a), I reproduce Fig. 3(a) of Ref. [1]. The raw data for this figure correspond to what is plotted in Fig. 1(c) of the original Letter. I have used exactly these data for the plot on Fig. 1(b). The difference is outstanding and the explanation of the authors for this difference is "a fit to the grid and interpolation" that "was suggested by one of the referees." The strong coupling suggested in Fig. 1(a) from the nonlinear energy dispersion is not observed on the recorded data plotted in Fig. 1(b).

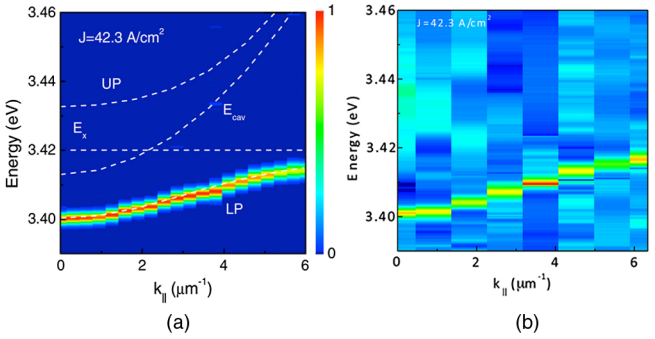

FIG. 1. (a) Reproduction of Fig. 3(a) from Ref. [1]. (b) The same figure with the raw data extracted from Fig. 1(c) of Ref. [1]. Both figures use the same color scale.

Figure 2(a) corresponds to Fig. 2(b) of Ref. [1]. In order to provide a meaningful discussion, I compare the 42.3 A/cm^2 curve in Fig. 2(b) of Ref. [1], to the corresponding data in Fig. 1(c) of Ref. [1]. It is astonishing to see that the very strong background signal present in the figure plotted in Fig. 1(c) of Ref. [1] has disappeared completely in Fig. 2(b) of the same Letter. In the same way, the linewidth of the main peak appears to be very different in the two figures.

In Fig. 2(c), I am expanding the main peak of the published Fig. 2(b) of Ref. [1]. Two important issues must be acknowledged. (i) The signal disappears in this plot over a large range of energies. According to the authors, this is linked with a subtraction procedure. I have not been able to get the raw data before this subtraction. (ii) The shape of the main peak is very strange. This peak should basically show a Lorentzian shape given by the very short lifetime of the polaritons in the structure. Alternatively, some Gaussian broadening might be due to the inhomogeneities of the sample. This is not what we have here. The fact that the signal drops by a factor of 10 over a single pixel on both sides of the main peak makes us doubt the accuracy of the measurement.

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Received 3 November 2015; published 6 July 2016
DOI: 10.1103/PhysRevLett.117.029701

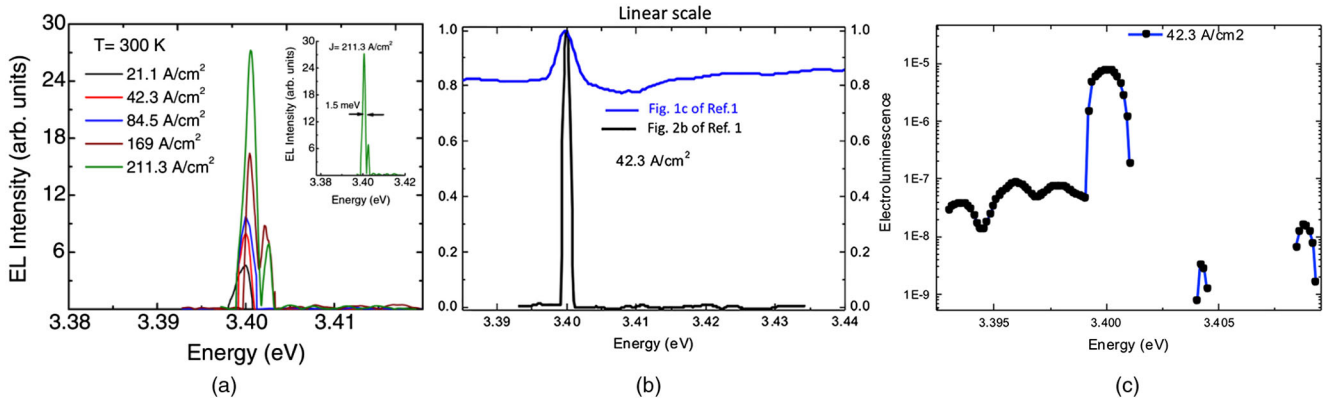

FIG. 2. (a) Reproduction of Fig. 2(b) from Ref. [1]. (b) Comparison of the 42.3 A/cm^2 data with those plotted in Fig. 1(c) of Ref. [1]. (c) Enlargement of the same data in log scale.

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