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CELL POLARITON: A QUANTUM STATE IN THE MYELIN SHEATH OF A NERVE

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Various polaritons are raising significant interest in physics and materials science for their unique and unexpected properties, especially their condensation, lasing without population inversion, and even room-temperature superfluidity. Here, we propose a cell polariton (CP): a collective coherent mode of a photon with the ensemble of all phospholipid molecules in a myelin sheath formed by glial cells. CP can be found resonantly self-confined in the myelin sheath under physiological conditions. This mode arises from the very compact, ordered and polar thin-film structure of the sheath, and the relatively strong coupling between the mid-infrared photon and the vibration modes of phospholipid tails in the myelin. The collective CP mode is then basically a coherent superposition of the photon and vibration modes within the myelin. It enhances the myelin permittivity significantly and forms a resonance state that involves the sheath cell. Our findings provide a new understanding of highly efficient energy utilization by neural cells, as well as a paradigm for the design of highly efficient energy transport in materials and devices.

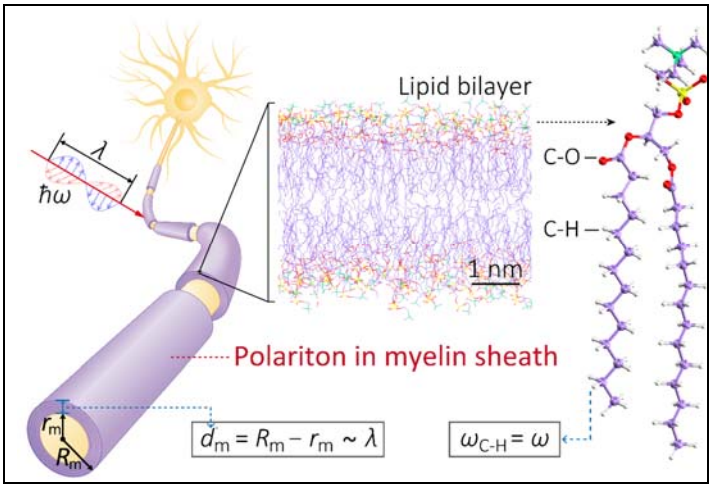

Figure 1. Cell-polariton resonantly and coherently forming in myelin sheath.

References

[1] B. Song and Y. Shu, Cell vibron polariton resonantly self-confined in the myelin sheath of nerve. Nano Res. **13**, 38–44 (2020).