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A condensed matter field theory for quantum plasmonics FOUAD BALLOUT, ORTWIN HESS, Imperial College London — In recent years plasmonics has advanced to ever decreasing length scales reaching dimensions comparable to the de broglie wavelength of an electron, which has a manifest influence on the plasmon dispersion relation. The associated phenomenology lies beyond the reach of the classical drude free electron theory or its nonlocal extension and adequate models are needed to address the quantum matter aspects of light-matter interaction that are responsible for plasmonicquantum size effects. We present on the basis of the jellium model a quantum field theory of surface-plasmon polaritons in which they emerge as extended objects as a result of an inhomogeneous condensation of bosons around a topological singularity describing the surface. The benefit of this approach lies in relating the electromagnetic fields belonging to such a macroscopic quantum state with the surface topology and nonlocal responsefunction (expressed in terms of the retarded photon self-energy) of the delimited electron gas sustaining that state.

Fouad Ballout
Imperial College London

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