Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

On the Interfacial Tunneling Current in Nanoscale Plasmonic Junctions[1] Y.Y. LAU, PENG ZHANG, R.M. GILGENBACH, University of Michigan — Recently, electron tunneling between plasmonic resonators is found to support quantum plasmon resonances [1], which may introduce new regimes in nano-optoelectronics and nonlinear optics. This is a fundamental problem of electron transport in nano-scale. Here, we present a self-consistent model of electron transport in a nano-scale metal-insulator (vacuum)-metal junction [2], by solving the coupled Schrödinger and Poisson equations. The effects of space charge, exchange-correlation, anode emission, and material properties of the electrodes and insulator are examined in detail. It is found that these effects may modify the current density by orders of magnitude from the widely used Simmons' formula [3]. Transition from the direct tunneling regime to the space-charge-limited regime is demonstrated. For a given junction, simply increasing the driving field to field emission or space-charge-limited regime could significantly reduce the damping of the charge transfer plasmon due to quantum tunneling.

[1] S. F. Tan, et al., Science 343, 1496 (2014); R. Esteban, Nat. Commun. 3, 825 (2012).
[2] P. Zhang, Sci. Rep., 5, 9826 (2015).
[3] J. G. Simmons, J. Appl. Phys. 34, 1793 (1963).

[1]This work was supported by AFOSR Grant No. FA9550-14-1-0309.

Peng Zhang
Univ of Michigan - Ann Arbor

Date submitted: 24 Jul 2015 Electronic form version 1.4