Abstract Submitted
for the TSF17 Meeting of
The American Physical Society

Ultrasensitive Detection of Neurotransmitters by Surface Enhanced Raman Spectroscopy for Biosensing Applications KATIA OCHOA, University of Texas at El Paso, Department of Biological Sciences, KEVIN BENNET, JONATHAN TOMSHINE, SETH HARA, MALCOLM MCINTOSH, Mayo Clinic, Division of Engineering, Rochester MN 55905 USA, JOHN CIUBUC, EMMA SUNDIN, University of Texas at El Paso, Department of Biomedical Engineering, CHAO QIU, WILLIAM DURRER, Department of Physics, MICHAEL EASTMAN, Department of Chemistry, FELICIA MANCIU, University of Texas at El Paso, Department of Physics, Border Biomedical Research Center, El Paso TX 79968 USA
— In this study, fabrication of silver nanoparticles (Ag NPs) as surface-enhanced Raman spectroscopy (SERS) active platforms enabled detection of serotonin, adenosine, and dopamine at concentrations as low as 10^{-11} molar. Besides demonstrating the potential value of this high sensitivity Raman recording of these very important analytes in the diagnosis of numerous neurological diseases, we observed variations in the intensities of characteristic Raman signatures that indicate changes in the molecular orientations of the neurotransmitters in the proximity of the silver surface, as well as potential chemical interactions. We also found that the particular Raman cross sections of neurotransmitter molecules and their densities close to the surface of Ag NPs play a significant role in preferential SERS enhancement. This study not only provides direct evidence that, using Raman spectroscopy, label-free detection of trace amounts of neurotransmitters is achievable, but it further advances knowledge of their interactions at the interface with metal nanoparticles.

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Date submitted: 28 Sep 2017 Electronic form version 1.4