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Photoabsorption by Volume Plasmons in Metal Clusters[1] CHUNRONG YIN, CHUNLEI XIA, VITALY KRESIN, University of Southern California — Metal clusters exhibit strong photoabsorption resonances in the visible part of the spectrum. These are collective "surface plasmon" excitations which have been extensively investigated. However, the UV part of the spectrum has remained rather unexplored. Some theoretical calculations have predicted that a measurable portion of the delocalized valence electrons' dipole oscillator strength should be located in this region. This predicted absorption feature has been ascribed to a volume-plasmon type of excitation, which in small particles can couple to light, in contradistinction to the situation in bulk metals. We have carried out a photodepletion cross section measurement on a pair of prototypical simple-metal nanoclusters, Na_{20} and Na_{92}, finding that these systems indeed possess a broad volume-plasmon absorption peak centered at ≈4 eV and having an oscillator strength contents of ≈15-20% of the total, in good agreement with theoretical calculations. These spectra provide the first experimental confirmation of the existence of optically active volume-type collective electronic excitations in metal nanocluster particles.

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