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Novel acoustic surface plasmons on Cu(111)[1] KARSTEN POHL, BOGDAN DIACONESCU, University of New Hampshire, LUCA VATTUONE, MARIO ROCCA, Universita di Genoa, Italy — The recent discovery of a fundamentally new sound-like plasmon on a bare metal surface of beryllium introduced a new research direction in the area of plasmonics [1]. While conventional surface plasmons are optical modes and have a finite excitation energy of a few eV, the novel acoustic mode can be excited with very low energies of a few meV. This allows, in principle, for a coupling with visible light for signal processing and advanced microscopies as well as new catalysts on metallic surfaces. In order to show that this novel excitation is a general phenomenon on closed-packed noble metal surfaces, as predicted by our theoretical collaborators [2], we have measured the dispersion of the acoustic surface plasmon on Cu(111) by electron energy-loss spectroscopy for a parallel momentum-transfer range from 0 to 0.15 1/Å. We can report that the dispersion is indeed linear (acoustic) with a slope (sound velocity) in good agreement with theory [2], and energy values that extend up to 500 meV. We will discuss the lifetime (decay length) of acoustic surface plasmons.

[1] B. Diaconescu, K.Pohl, L. Vattuone, et al., Nature 448, 57 (2007).
[2] V.M. Silkin, J.M. Pitarke, et al. Phys. Rev. B 72, 115435 (2005).

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