

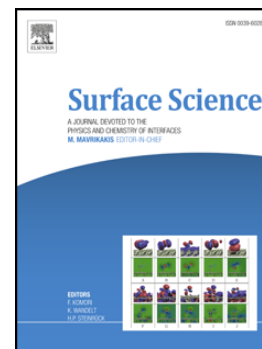
# Accepted Manuscript

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PII: S0039-6028(15)00179-X  
DOI: doi: [10.1016/j.susc.2015.06.021](https://doi.org/10.1016/j.susc.2015.06.021)  
Reference: SUSC 20551

To appear in: *Surface Science*



Please cite this article as: S. Tognolini, S. Pagliara, L. Bignardi, S. Ponzoni, P. Rudolf, F. Parmigiani, Surface States Resonances at the Single-Layer Graphene/Cu(111) Interface, *Surface Science* (2015), doi: [10.1016/j.susc.2015.06.021](https://doi.org/10.1016/j.susc.2015.06.021)

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# SURFACE STATES RESONANCES AT THE SINGLE-LAYER GRAPHENE/Cu(111) INTERFACE

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## ABSTRACT

By tuning the laser photon energy in the non-linear two-photons photoemission at a single-layer graphene/Cu(111) interface it is possible to observe a strong resonance at  $h\nu = 3.5$  eV along with a weaker one at  $h\nu = 3.85$  eV. The main resonance photon energy is consistent with a direct optical transition between the occupied Cu(111) Shockley surface state and the  $n=1$  image potential state, located in the real gap-space between the single-layer graphene and the Cu(111) surface. The large amplitude of this resonance unveils a high value of the electric dipole matrix element integral that governs this transition. Furthermore, the Lorentzian shape of this resonance implies that these two states are decoupled from the continuum of states and the lifetime of the image potential state can be estimated.

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