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# Ab initio many-body calculations of the mean transverse energy for proposed high-brightness photocathode materials

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The state of the art in creating next-generation high-brightness electron beams requires that electrons emerge with mean transverse energy (MTE) of  $\sim 10$  meV or lower. Identification of new, promising materials requires predictive understanding of the physics underlying photoemission. This talk will present our first-principles ab initio solid-state calculations of MTE for a variety of proposed photocathode materials. Within the approximation that the vast majority of photoelectrons come from transitions among the bulk electronic states of the material, our calculations accurately reproduce the experimentally measured MTE as a function of photon energy for emission from PbTe(111), producing results that are significantly more accurate than previous theories [arXiv:1704.00194v1 [physics.acc-ph] (2017)] that underestimate these measured MTEs by a factor of 10–20. Using our new approach, we further find that the MTE from single-crystal Cs3Sb(001) is around 1–10 meV near the emission threshold, without any limitation being placed by the thermal  $\sim k_B T$  energy scale.

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**Session Classification:** Session 10

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