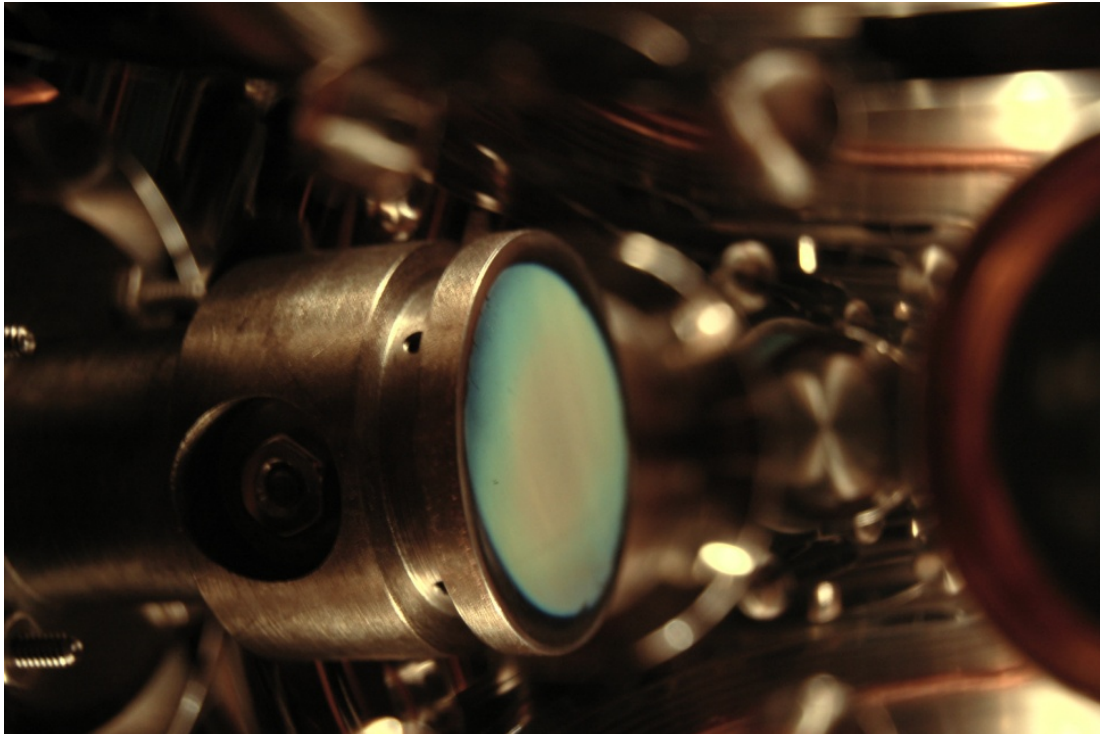


Changes In Cs_2Te Photocathode Fermi Level Due To Heating

Eric Wisniewski, Daniel Velazquez, Zikri Yusof, Linda Spentzouris, Jeff Terry, and Katherine Harkay



<http://arxiv.org/abs/1203.6632>,

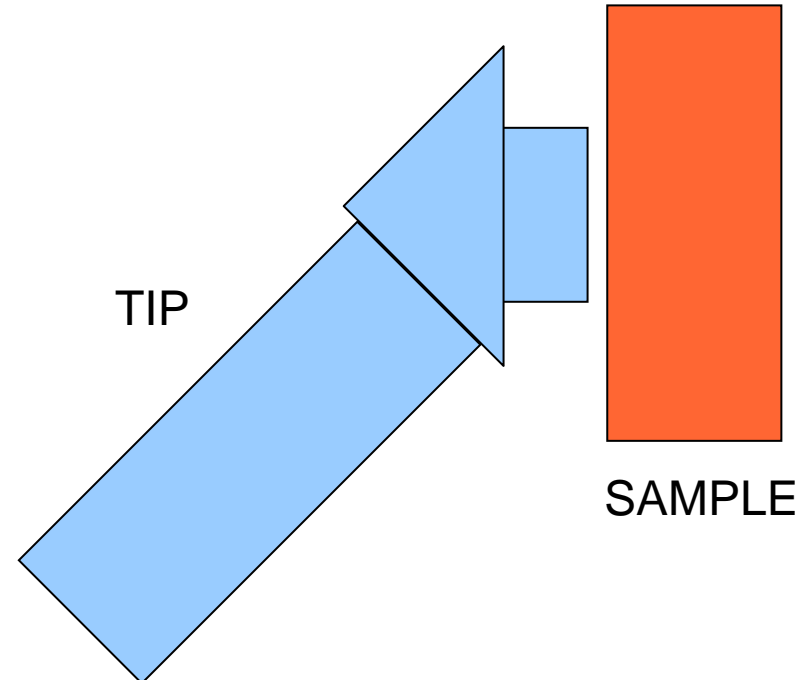
submitted to PRST-AB



Kelvin Probe Technique To Measure Work Function/Fermi Level



- Contact potential difference is measured between the probe and the sample;
- If the work function for the tip is known/calibrated, then the sample's "potential" can be obtained;
- For a metal, this "potential" is the work function/electron affinity. For a semiconductor, this is the work function/Fermi level.

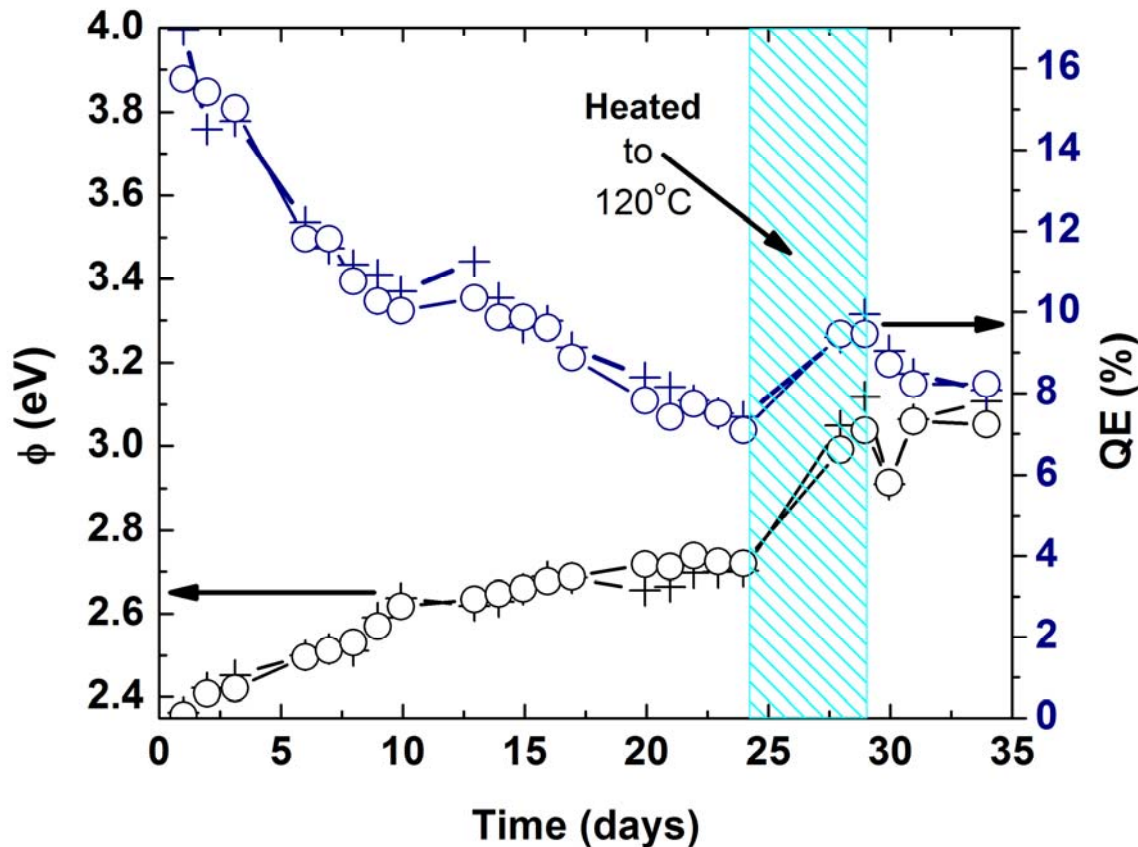


Tip diameter = 2 mm

Sub-millimeter sample to tip separation ~ 100 μ m

N. A. Surplice and R. J. D'Arcy, *J. of Phys. E: Scientific Instruments* 3, 477 (1970).

Unexpected Change In Work Function of Cs₂Te Photocathode During Reheating

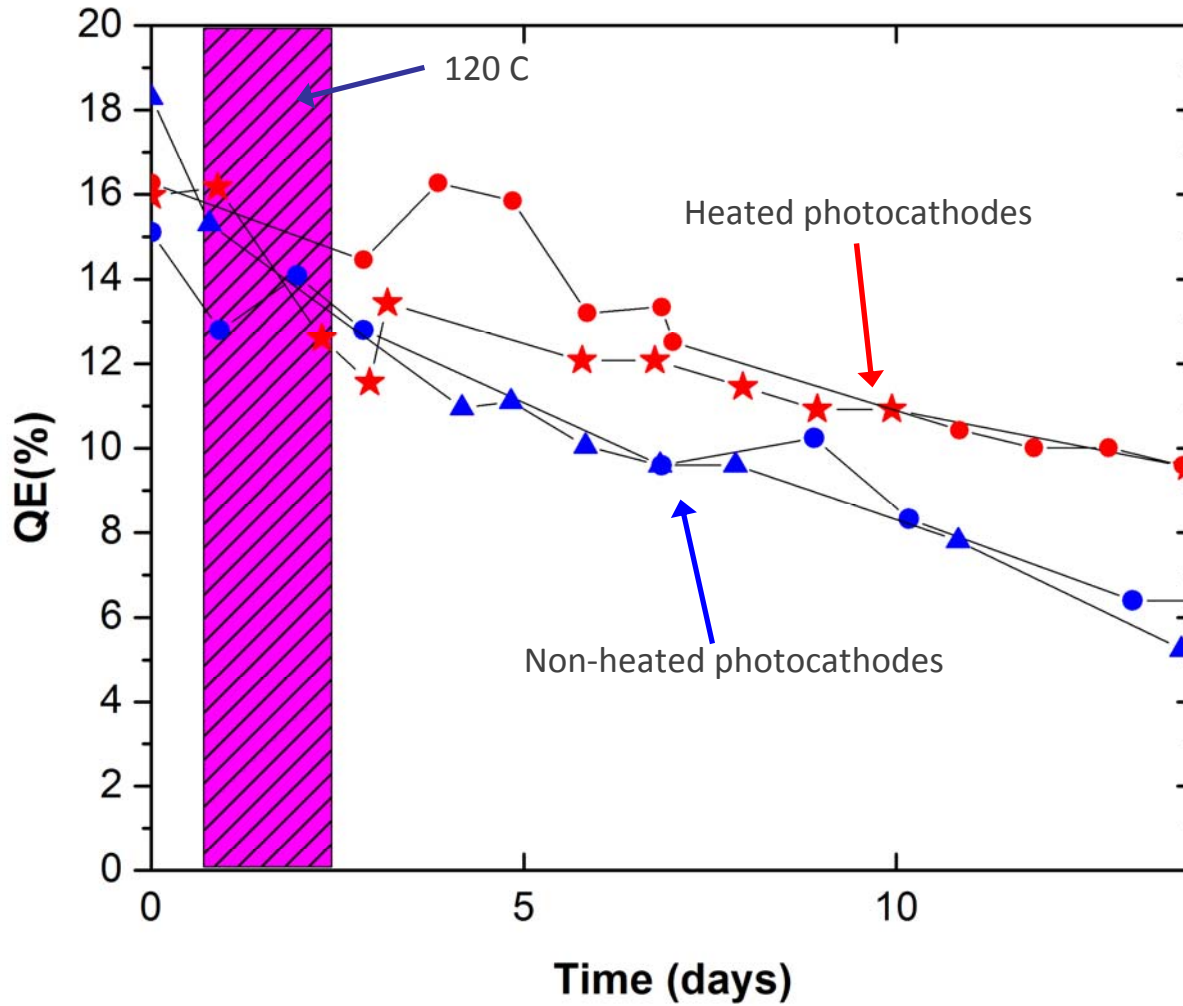


Photocathode kept in UHV; base pr= 2×10^{-10} Torr

- QE slowly decays in UHV, accompanied by an increase in work function; consistent with $QE \sim (h\nu - \phi)^n$ ($n > 0$);
- Upon heating, both QE and work function increase, not consistent with trend;
- QE appears to drop slower after heating.



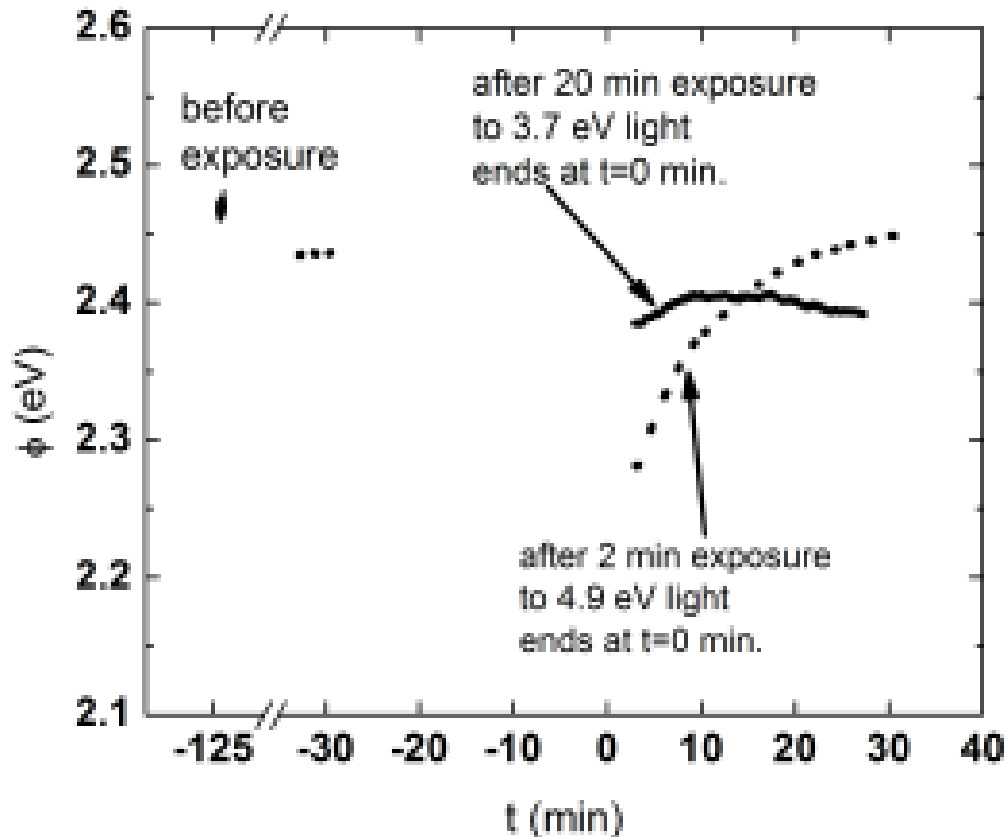
Heating "Stabilizes" QE



- We heat the photocathode 1 day after deposition;
- QE drops less rapidly for heated photocathode when compared to non-heated photocathode.



UV Light Affects Work Function



- Exposure to 4.9 eV light caused the work function to temporarily drop – recovers in ~ 30 mins;
- Exposure to 3.7 eV light shows little to very small change;
- Michelato et al. (NIM-A **393**, 464 (1997)) observed QE rejuvenation with heating AND 4.9 eV exposure, but no significant rejuvenation with 3.7 eV exposure. Coincidence?
- Similar effects have also been seen in ITO (Kim et al., Syn. Metals **111**, 311 (2000)).

