# CALIFORNIA STATE SCIENCE FAIR
# 2012 PROJECT SUMMARY

**Name(s)**

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**Project Number**

**J2133**

**Project Title**

## Sunscreen SPF Effectiveness: A Spectral Study of Sunscreen Using a Mercury Vapor Lamp

**Abstract**

**Objectives/Goals**

I measured visible and UV wavelengths emitted from a mercury vapor lamp as they pass through a cell containing sunscreen of various sun protection factors (SPFs). I hoped to observe selective attenuation of the UV wavelength. Also, I wanted to estimate the thickness of sunscreen required to screen out UVA radiation.

**Methods/Materials**

Light emitted from a mercury vapor lamp was filtered by a monochrometer into 578nm (yellow), 546nm (green), 436nm (blue), 404nm (violet), and 365nm (ultraviolet-UVA) wavelengths. These wavelengths were passed through a cell containing the sunscreen and also through an alcohol (sunscreen solvent) control. A photo-detector measured the optical power in each wavelength (with the sunscreen and with the control) and a normalized spectral transmission was measured for pure SPFs of 15, 30, 50 and 100. Dilutions of SPF-15 were made to measure UVA transmission at 365nm.

**Results**

All SPFs were effective in attenuating 404nm (violet) and 365nm (ultraviolet). Even blue at 436nm was somewhat attenuated by the higher SPF values. Visible lines at 578nm (yellow) and 546nm (green) were fully transmitted. Dilution of SPF-15 by over 3000X was required to observe UVA radiation at 365nm. Using the liquid cell thickness of 3cm, I estimated that less than 10 microns of SPF-15 is effective in screening UVA radiation.

**Conclusions/Discussion**

The selective attenuation of UV light by sunscreen was confirmed. An estimated thickness required for effective screening of UVA was determined. In the future, these measurements could be repeated using deeper UV lines in the UVB band.

**Summary Statement**

I made a spectral study of 4 different SPF sunscreens using the 5 dominant emission wavelengths of a mercury vapor lamp to determine the thickness of sunscreen required for adequate protection.

**Help Received**

Father, Kerry Vahala: Helped with experiment and write-up. Mother, Karen Vahala: Helped procure materials, and prepare poster.