Section 4: Observation 2: The Photoelectric Effect (In Progress)

When a light source is directed at a metal surface, it is found under many circumstances that electrons are ejected from the surface. This phenomenon is called the "photoelectric effect." These electrons can be collected to produce a usable electric current. (This effect has a variety of common practical applications, for example, in "electric eye" devices.) It is reasonable to expect that a certain amount of energy is required to liberate an electron from a metal surface, since the electron is attracted to the positively charged nuclei in the metal. Thus, in order for the electron to escape, the light must supply sufficient energy to the electron to overcome this attraction.

The following experimental observations are found when studying the photoelectric effect. First, in order for the effect to be observed, the light must be of at least a minimum frequency which we call the threshold frequency, ν_0

. This frequency is a characteristic for a given metal. That is, it is the same value for each sample of that metal, but it varies from one metal to the next. For low frequency light, photoelectrons are not observed in any number, no matter how intense the light source is. For light with frequency above ν_0, the number of photoelectrons emitted by the metal (measured by the photoelectric current, Φ) increases directly with the intensity of the light. These results are shown in Figure.

1a : For photoelectrons to be emitted, the light frequency must be greater than a threshold value. 1b : If the frequency is high enough, the number of photoelectrons increases directly with the light intensity.

Figure 1. is the photoelectric current, is the frequency of incident light, and is the intensity of incident light.