Photoelectric Effect

Apparatus

ultraviolet light source, e.g. a mercury lamp, an electroscope, a metal plate

The metal plate, e.g. zinc or aluminium, is placed atop the electroscope and covered by a perspex sheet.

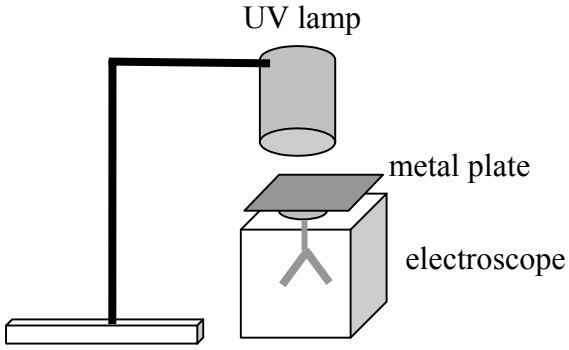
Action

The Students charge the electroscope so that it is negative, and the foil leaves move apart. The UV lamp is then turned on, and the perspex sheet removed. The electroscope leaves fall back together.

The physics

The UV photons collide with electrons in the metal plate, ejecting them if the energy of the photons is greater than the binding energy of the metal. The ejected electrons reduce the excess negative charge on the plate, which is connected to the electroscope. This reduces the charge on the leaves of the electroscope and they fall back together.

Note: it is almost impossible to start neutral and remove enough electrons to charge the electroscope as they recombine quickly to leave the electroscope neutral again.



Note: the perspex sheet is useful if the lamp takes a few minutes to warm up. The lamp can be turned on and the sheet used to block the UV radiation until the students are ready to use the demonstration.

Accompanying sheet:

Photoelectric Effect

The UV lamp takes several minutes to warm up.
Do Not expose yourself to UV radiation!
Do Not look up at the lamp filament!

You may need to charge the plate up initially using the electrophorus.
When the plate is charged (the leaves are separated) remove the perspex.
What do you observe?
What can you say about the work function of the metal plate?