/

Physics 410/510 Experiment E-15

Mass SpectroscopY

The object of this experiment is to determine the masses and abundance ratios of the isotopes of species among the alkali metal ions and to investigate, to some extent, the characteristics of the 180° focusing mass spectrometer. The operation and concept of the vibrating reed electrometer is to be considered.

It is a good idea to play with the apparatus using the ion emission capability of the filament as the last experimenter left it before opening the gun up and re-coating the ribbon with new material. However, this should be done at least once before serious data are taken.

Before turning on the oil diffusion pump, ascertain that the fore vacuum is adequate as indicated with the thermocouple gauge. Before turning on the diffusion pump, have the water flow adjusted to a reasonable rate (not wide open!). After the pump begins to warm up, immerse the' cold trap into the liquid N2 and maintain an adequate level. Before shutting down to quit or open the system up, allow the oil to cool off for 10-15 minutes and the cold trap, to warm up.

The magnetic field is from the regulated DC power supply by an AC system. Do not change the conditions in the regulator without first turning off the DC line switch on the regulator. To obtain an ion beam of lithium at reasonable voltages, a rheostat must be inserted in series with a magnet to get the field low enough to obtain the beam at the collector slit.
On heating up the filament ribbon, a large amount of gas is evolved. But this will gradually be removed and the vacuum will gradually improve until it is in the 10-5 range.

The magnetic field will be determined by a flux meter measurement, the flip coil being inserted into the field between the input and output leads of the spectrograph.

As a rough start, the potassium peaks should occur at about .63 amps field current, 70- 75 volts accelerating potential. The conditions on the gun will have to be explored for optima.

While cesium ions are not normally to be expected in quantity, there may be a detectable

peak.

References:

1. Hamwell and Livinggood, *Experimental Atomic Physic.s,* pp. 133-152. 2. American Journal ofPhvsics, 28, p. 452 (1960).

3. *Ingram,Advance.~ in Electronics,* Vol. I, p. 219 (1948). 4. Kerwin, *Advances in Electronics.* Vol. II, p. 188 (1956).

6. Palevsky, Swank, Grenchik, Review of Scientific Instruments. vol. 18, no.5, p. 298 (1847). (On the Vibrating Reed Electrometer)

Sept. 1,1994.