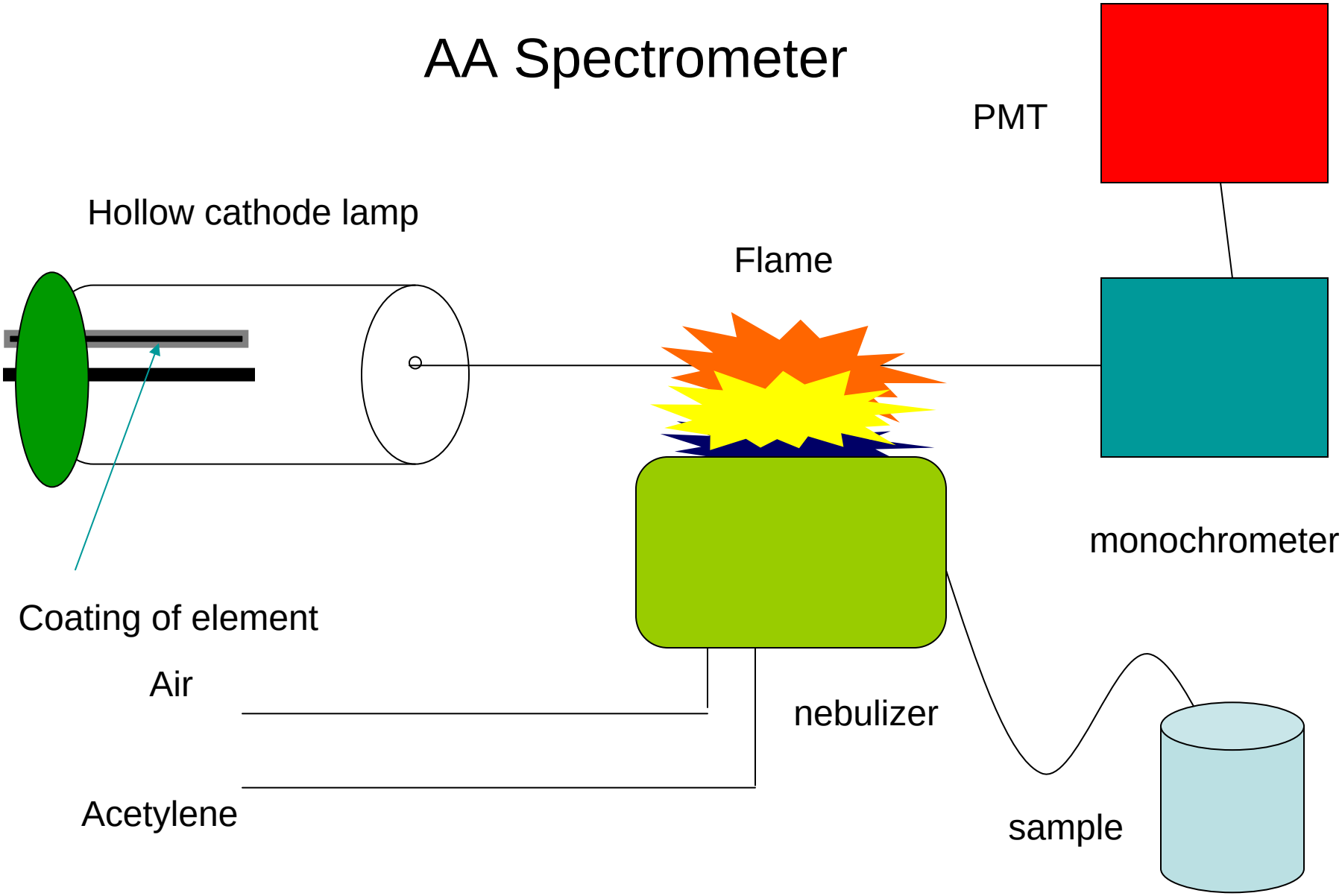
Atomic Absorption Spectroscopy

- Elemental analysis
- Dissolved metals
- Source
  - Hallow Cathode Lamp
  - Cathode of specific element
- Sample
  - Acetylene-air flame, nebulizer
- Detector
  - Photo Multiplier Tube

Atomic absorption

- Gas-phase elemental atoms
- Narrow absorption lines (±0.01 nm)
  - No solvent
  - No vibrations and rotations
- Element specific source
- Flame conditions control sensitivity
- 1-100 ppm (mg/L)
- varies with element

AA Spectrometer



Removal of Atomic Emission

- Place a chopper before the flame
- The signal from the source is modulated by the chopper
- Thus, a AC signal is produced on top of a DC signal that originates from emission in the flame

Experiment

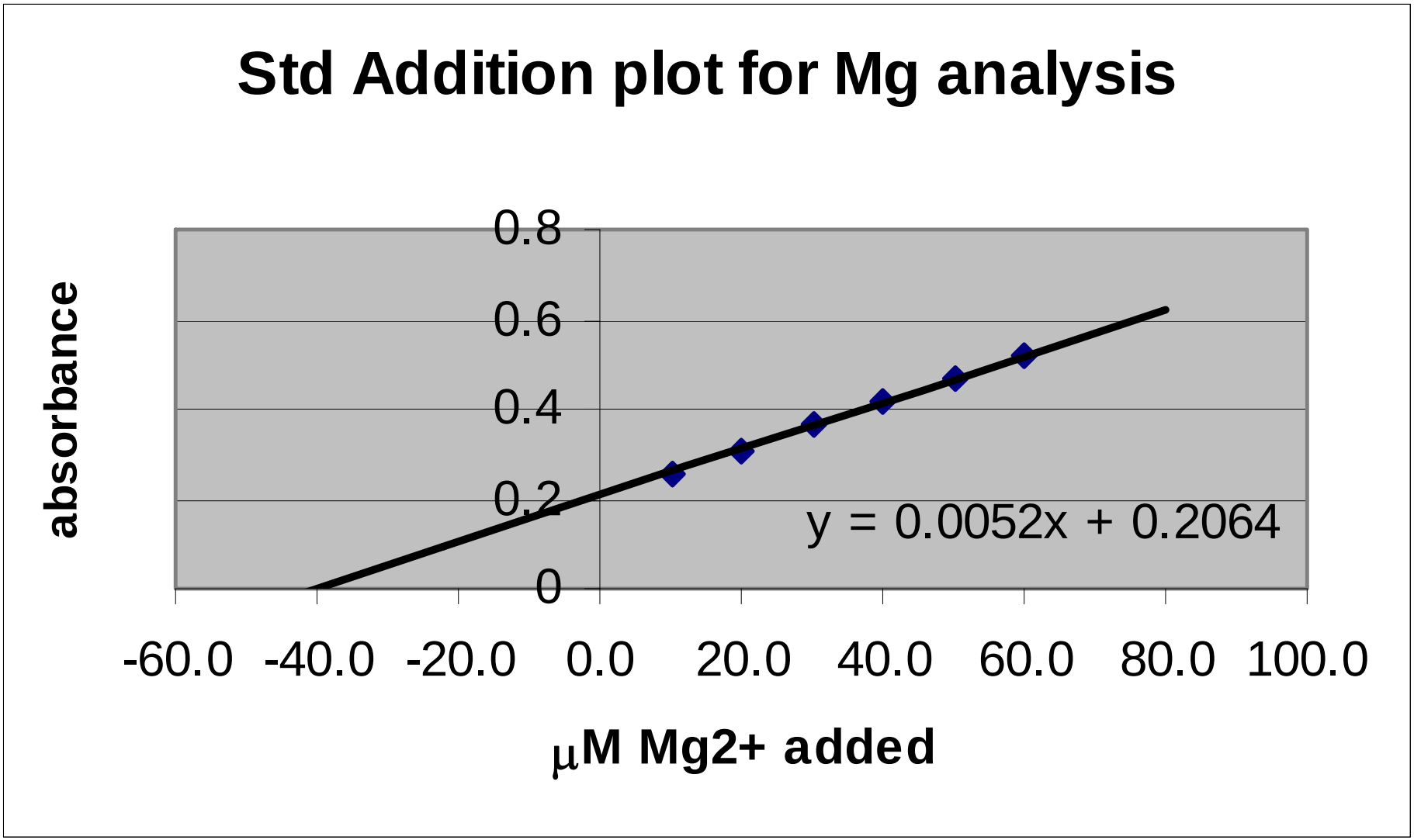
- Aspirate blank, set 100 % T
- Aspirate sample
- Matrix Effects are common
  - Standard addition experiment

Standard Addition Analysis

- Add known quantities of standard to your sample and plot abs vs. concentrated added
  - This way each of the samples that make up the standard curve contain the same matrix effects.

Typical Standard Addition Experiment

sample	Unknown solution (mL)	200 μM Mg^{2+} std (mL)	total volume (mL)	[Mg^{2+}] added (μM)	abs
A	5.00	0.500	10	10.0	0.258
B	5.00	1.000	10	20.0	0.310
C	5.00	1.500	10	30.0	0.362
D	5.00	2.000	10	40.0	0.414
E	5.00	2.500	10	50.0	0.467
F	5.00	3.000	10	60.0	0.518


Std Addition plot for Mg analysis
absorbance
0.8
0.6
0.4
0.2
0
y = 0.0052x + 0.2064
-60.0
-40.0
-20.0
0.0
20.0
40.0
60.0
80.0
100.0
μM Mg2+ added

Atomic Emission Spectroscopy

- Emission of light from exited species
- ICP source
- Multi-element analysis
  - Fancy optics
- Greater sensitivity for most elements

ICP source

- Ar tourch
  - Very hot , 10000 K
  - Abundance of e- inhibits ionization
  - Lack of O_2 inhibits oxide formation
  - Excited atomic species predominate
  - 5-20 L/min

Sample Introduction

- Nebulizer
- Electrothermal vaporization
- Laser ablation
- In either case Ar gas in used to carry sample into the ICP

AE Instruments

- Optics are expensive and complex
- Because emission lines are very narrow and many lines for different elements are relatively close together