Interesting X-ray intensities of 241Am L X-ray intensities:

- 241Am is widely used for efficiency calibration of semiconductor (SC) spectrometers (γ-ray at 59.5 keV and X-rays between 11 and 23 keV).
- X-ray intensities are used to balance the nuclear decay scheme because numerous γ transitions are abundant.
- X-ray intensities are important atomic fundamental parameters (FPs).

Difficulties to calculate the X-ray intensities:

- Statistical fluctuations:
  - For SC spectrometers ~ 3 eV are required to create an electron-hole pair.
  - For MMCs, only ~ 5 eV are required to thermally excite a state.
- Signal-to-Noise Ratio:
  - Low temperature T required ~ 50 mK to minimize the detector heat capacity C.
  - At low temperature high energy resolution achievable (ΔE_{FWHM} = 27 eV below 60 keV).

Difficulties to measure these intensities:

- Measured values of intensities with SC spectrometers:
  - Their FWHM energy resolution is too large to separate the peaks lying between 11 and 23 keV.
  - Their efficiency varies of ~ 10% between 11 and 23 keV.

X-ray intensities by EDXRS with Metallic Magnetic Calorimeter (MMC)

Energy resolution of MMCs

- Statistical fluctuations:
  - For SC spectrometers ~ 3 eV are required to create an electron-hole pair → FWHM = 120 eV at 6 keV.
  - For MMCs, only ~ 5 eV are required to thermally excite a state → energy resolution not limited by statistical fluctuations but by the signal/noise ratio.

- Signal:
  - Low temperature T required < 50 mK to minimize the detector heat capacity C.

- Noise:
  - Thermal noise : $\propto T^{-1}$ (T$_b$)
  - SQUID noise : $\propto T$

  → At low temperature high energy resolution achievable (ΔE_{FWHM} = 27 eV below 60 keV).

Experimental set-up

Results

Conclusions

- Many peaks well separated
- Lower systematic errors due to the fitting procedure
- More confident data.

Energy spectrum analysis

- Full energy peaks fitted with Voigt functions.
- Lorentzian widths fixed with values from J.L. Campbell (2001).
- Gaussian detector FWHM fixed to 29 eV (calibrated @ 26.3 keV)

New intensities for 34 L X-ray transitions with a high energy resolution MMC:

- Lower systematic errors due to the fitting procedure
- More confident data.