

Summer Research Project at Goddard Space Flight Center

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Laboratory for Extraterrestrial Physics

- Use of gamma ray detectors in space exploration
- Application of NASA technology to forensic sciences

CdZnTe Detectors

- New solid state detector
 - Good resolution at room temperature
 - Better efficiency
- Swift project
 - uses 40,000 CdZnTe detectors
 - <http://swift.gsfc.nasa.gov>
- Future Mars Exploration projects



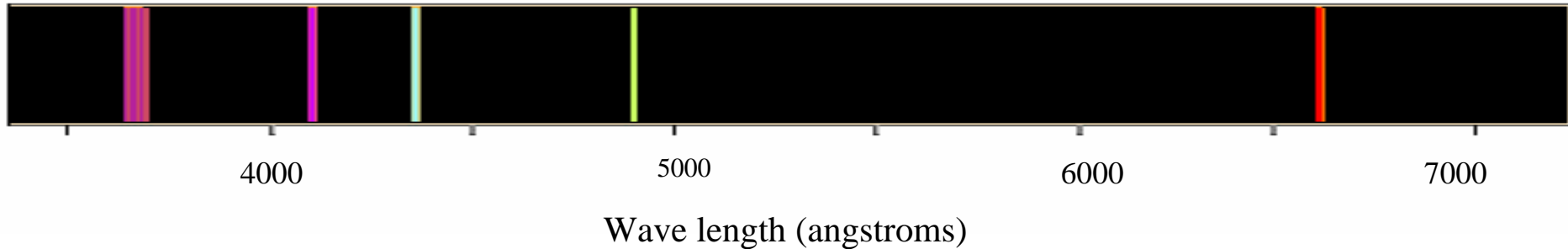
<http://swift.gsfc.nasa.gov/>



<http://mars.jpl.nasa.gov/mer/overview/>

Spectroscopy

Characteristic spectrum of hydrogen

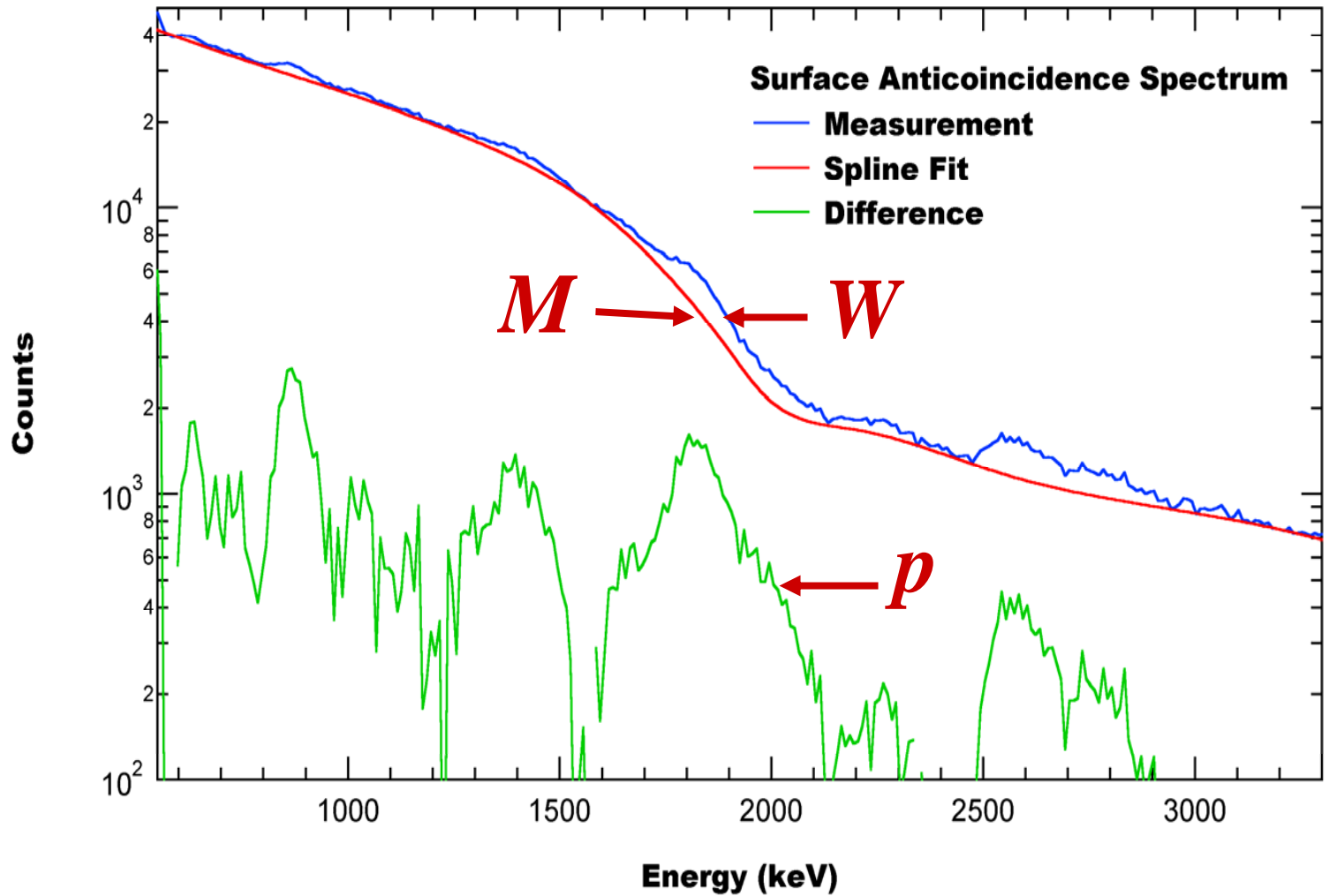


Each Element has its own unique characteristic spectra

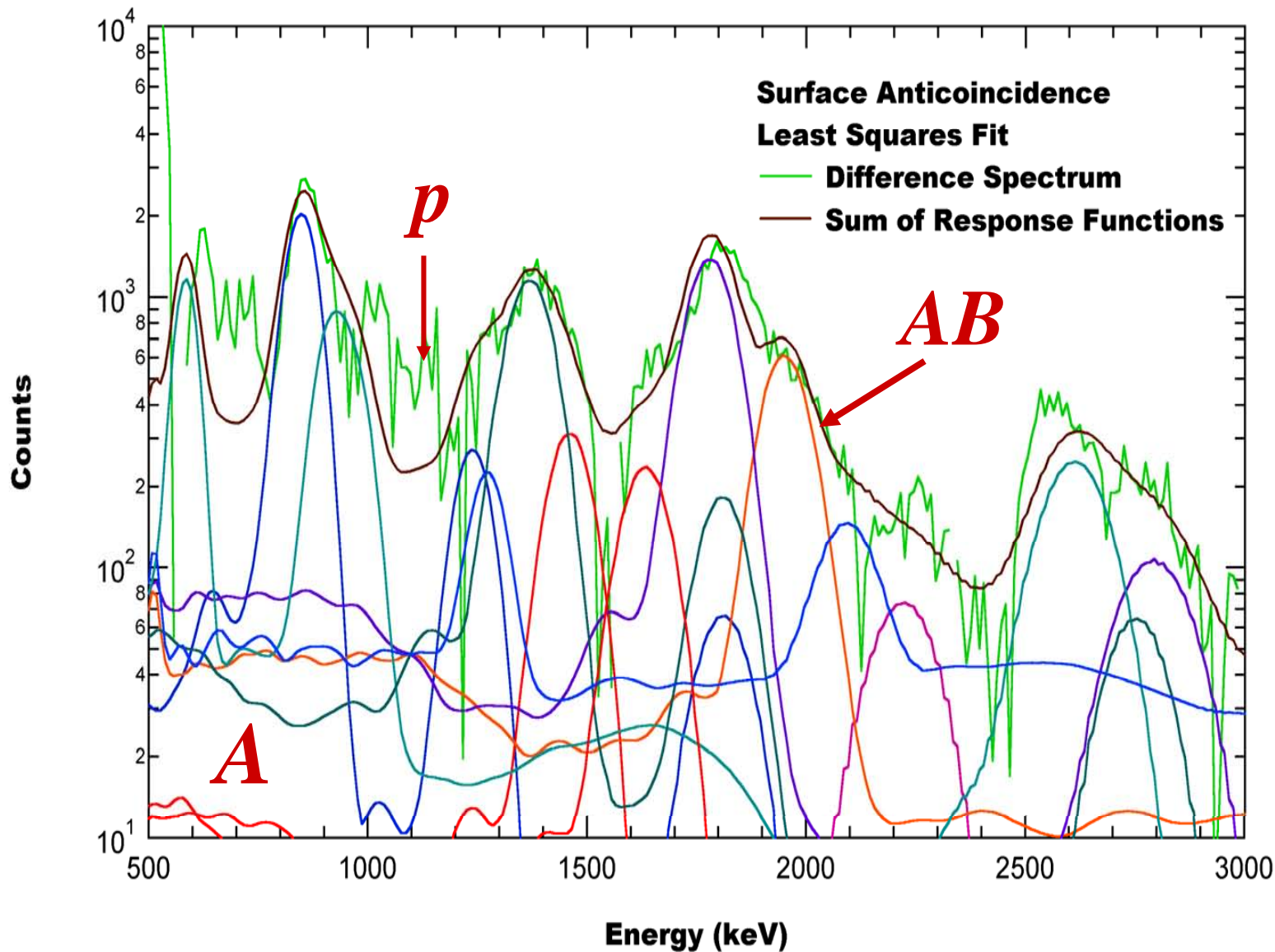
Analysis of a substance's spectra gives the chemical composition

Radiation detector counts the number of photons for each energy

Example: NEAR GRS, Eros Surface Spectrum



Example: Fit to Difference Spectrum, NEAR GRS



Spallation Products

- Cosmic ray hits nucleus
- Nucleus breaks apart
- Resulting products are radioactive isotopes

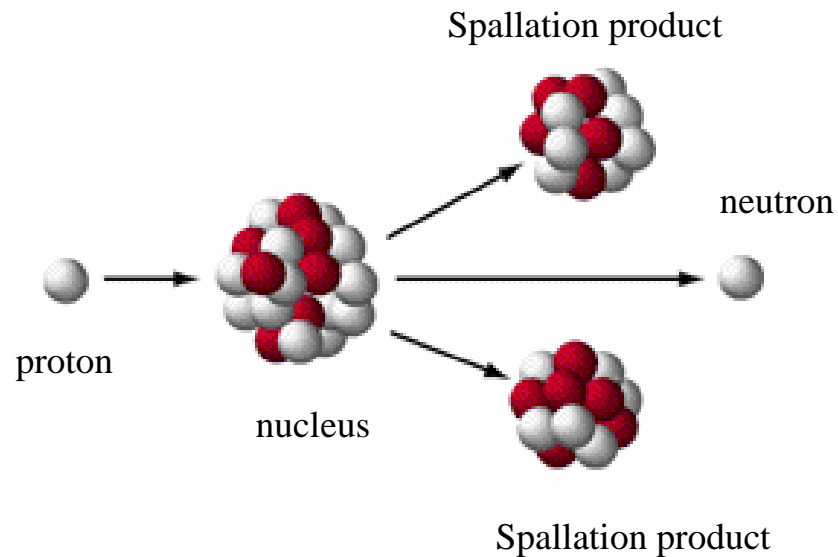


Table of Spallation Products

Isotope(halflife)	Decay Mode	Particle Energy (Mev)	γ Energy (Mev)
$^{124}\text{I}(4.15\text{d})$	ec, β^+	2.134 ₁₀ (†49.0) 1.533 ₄ (†46.2) 0.808(†4.8)	.603(61%),1.691(10.4%)
$^{121}\text{I}(2.12\text{h})$	ec, β^+	1.2	.212(84%)
$^{129\text{m}}\text{Te}(33.6\text{d})$	β^- , IT	1.595 0.910	.696(3%)
$^{123\text{m}}\text{Te}(119\text{d})$	ec, IT		.159(84%)
$^{121\text{m}}\text{Te}(154\text{d})$	ec, β^+ , IT		.212(81%)
$^{121}\text{Te}(16.8\text{d})$	ec		.573(80%)
$^{119\text{m}}\text{Te}(4.7\text{d})$	ec		.153(62%),.270(25%), 1.213(67%)
$^{119}\text{Te}(16\text{h})$	ec, β^+	0.627 ₂	.644(88%)
$^{117}\text{Te}(1.1\text{h})$	ec, β^+	1.75 ₃	.7198(66%)
$^{116}\text{Te}(2.5\text{h})$	ec, β^+	0.44?	.103(4%), .629(4%)

ec: electron capture

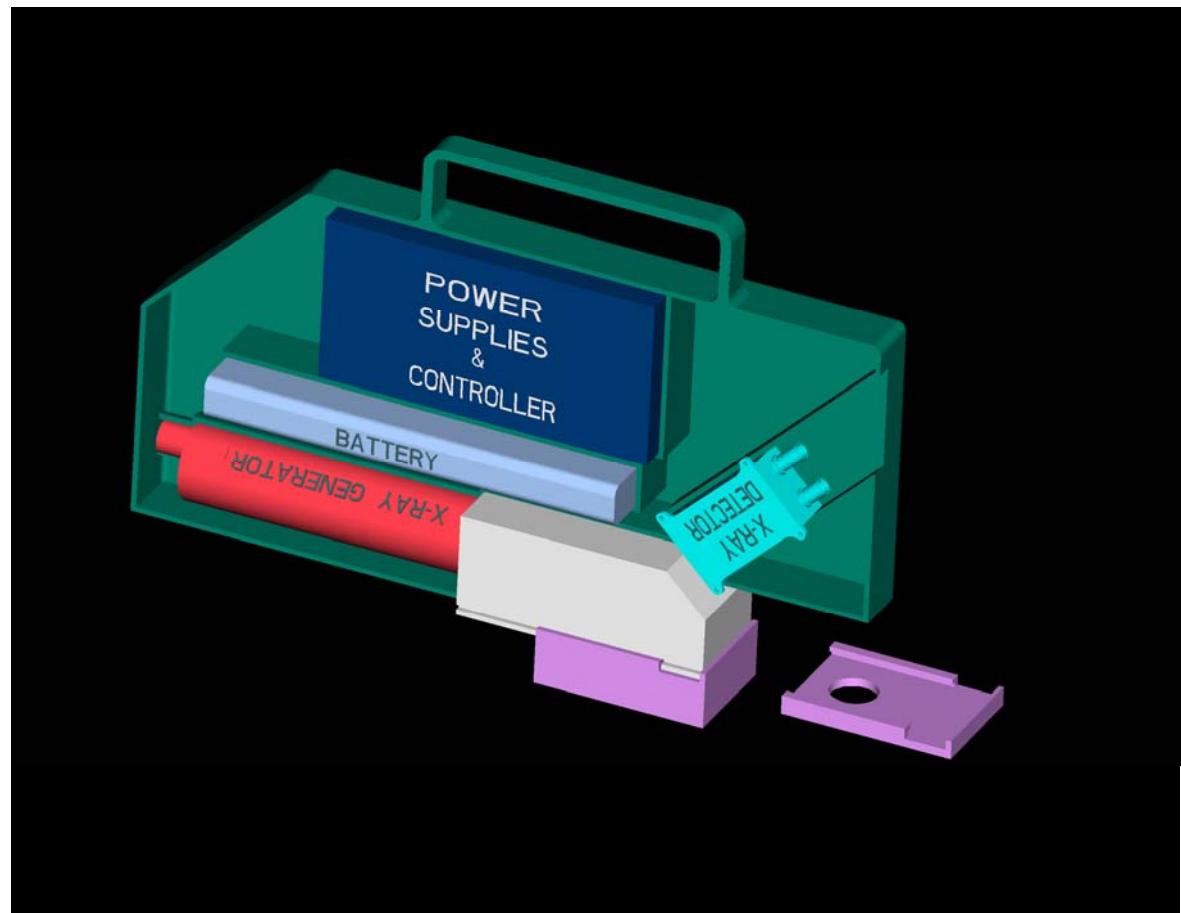
IT: isomeric transition

†: relative intensity

?: absolute intensity

X-Ray Fluorescence System

- Non destructive analysis
- Operated at crime scene



Acknowledgements

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