

# Applications

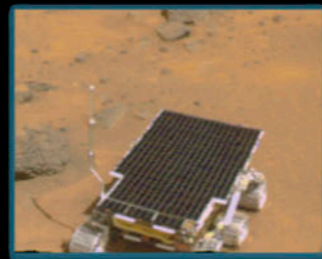
## Radioactive Dating

Naturally occurring radioactive isotopes such as  $^{14}_6\text{C}$  are used to date objects that were once living, such as wood. For example, from a study of artifacts found at the site, scientists determined that Stonehenge was built nearly 4,000 years ago.



## Space Exploration

Sojourner used alpha particles to identify chemical elements present in Martian rocks. On Earth, nuclear reactions are used in many areas from criminal investigations to art authentication.



## Nuclear Reactors

Nuclear reactors use the fission of  $^{235}_{92}\text{U}$  or  $^{239}_{94}\text{Pu}$  nuclei to produce electric power. Reactors and most other nuclear applications generate radioactive waste; disposal of this waste is a subject of current research.



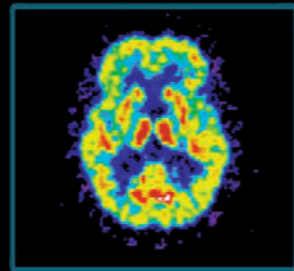
## Smoke Detectors

Many smoke detectors use a small amount of the alpha emitter  $^{241}_{95}\text{Am}$  to ionize the air. Smoke entering the detector reduces the current and sets off the alarm.



## Nuclear Medicine

Radioactive isotopes, such as  $^{99\text{m}}_{43}\text{Tc}$ ,  $^{60}_{27}\text{Co}$  and  $^{131}_{53}\text{I}$ , are commonly used in the diagnosis and treatment of disease. Positron emitters such as  $^{18}_9\text{F}$  are used in Positron Emission Tomography (PET) to generate images of brain activity.



## Magnetic Resonance Imaging

Magnetic Resonance Imaging (MRI) makes use of atomic transitions involving the magnetic field of a nucleus to study the local chemical environment. This technique accurately maps the density of hydrogen to produce three-dimensional images of the human body.

