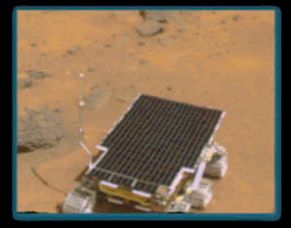
Applications

Radioactive Dating

*N*aturally occurring radioactive isotopes such as $^{14}_{6}\mathbf{C}$ 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

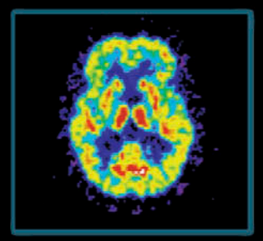
*S*ojourner used alpha particles to identify chemical elements present in Martian rocks. On Earth, nuclear reactions are used in many areas from criminal investigations to art authentication.

Nuclear Reactors

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

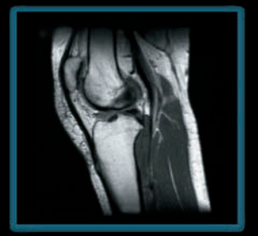
Smoke Detectors

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



Nuclear Medicine

*R*adioactive isotopes, such as $^{99m}_{43}\mathbf{Tc}$, $^{60}_{27}\mathbf{Co}$ and $^{131}_{53}\mathbf{I}$, are commonly used in the diagnosis and treatment of disease. Positron emitters such as $^{18}_{9}\mathbf{F}$ are used in Positron Emission Tomography (PET) to generate images of brain activity.



Magnetic Resonance Imaging

*M*agnetic 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.

Astrophysical pictures courtesy NASA/JPL/Caltech and AURA/STScI.