Traceable measurement of radionuclides for improved climate monitoring

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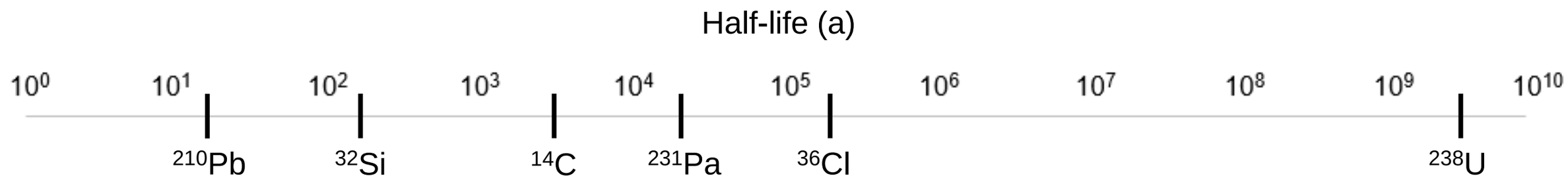
Introduction and Aims

- Radionuclides with cosmogenic and natural origins are present in a range of environmental samples, including terrestrial and ocean sediment, snow, and ice.
- These radionuclides can be measured using methods initially developed at NPL for decommissioning, environmental monitoring and forensic applications.
- This will contribute to improving the understanding of past, current and projected future climate change.
- This project aims to expand the number of climate change-relevant radionuclides measurable, improve nuclear decay data and provide traceable standards.

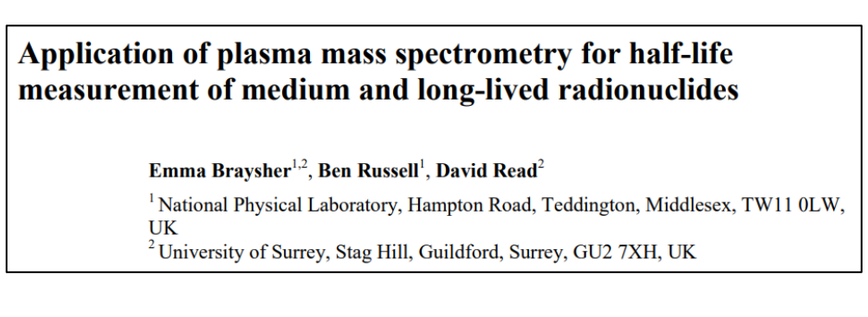
Applications

- NPL are improving measurement capability for radionuclides with half lives from tens to billions of years, contributing to climate modelling over various timescales.
- Details of progress for several radionuclides are given below.



Uranium-238 ($4.468\ (5) \times 10^9$ a)

- Establishing atom counting capability of ICP-MS/MS for contribution to half life measurement.
- Isotope dilution method applicable to U isotopic ratios.



Application of plasma mass spectrometry for half-life measurement of medium and long-lived radionuclides

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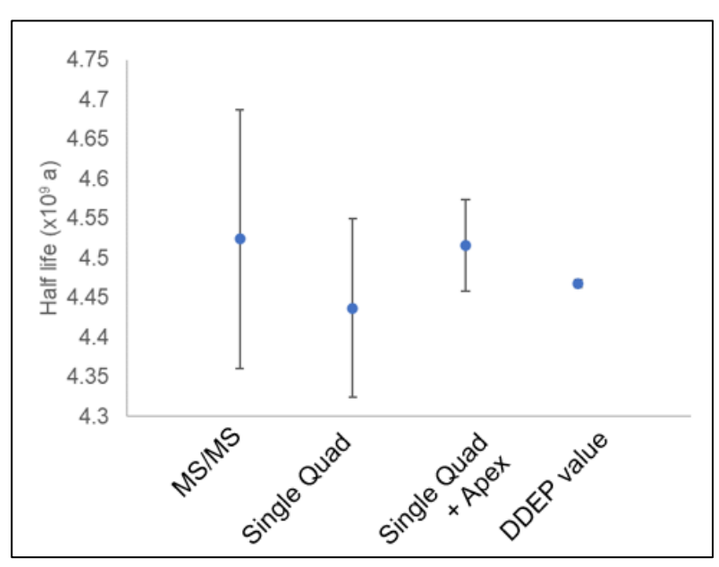
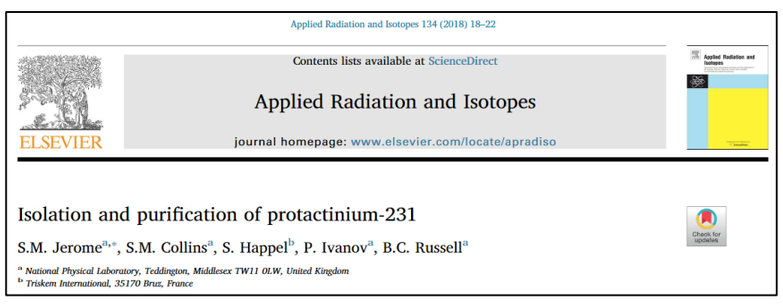


^{238}U values achieved with ICP-MS/MS setups

Protactinium-231 (32,670 (260) a)

- Updated half-life measurement, improved separation.
- Development of new standard.



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Isolation and purification of protactinium-231

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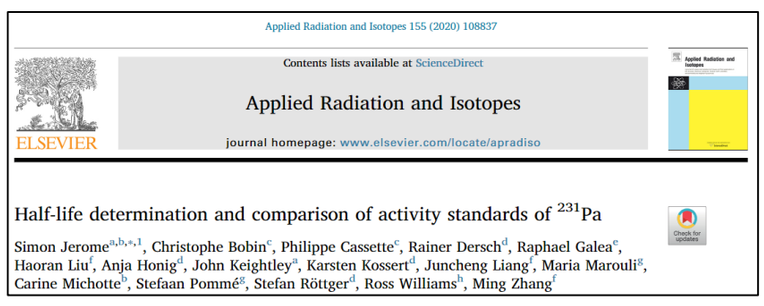

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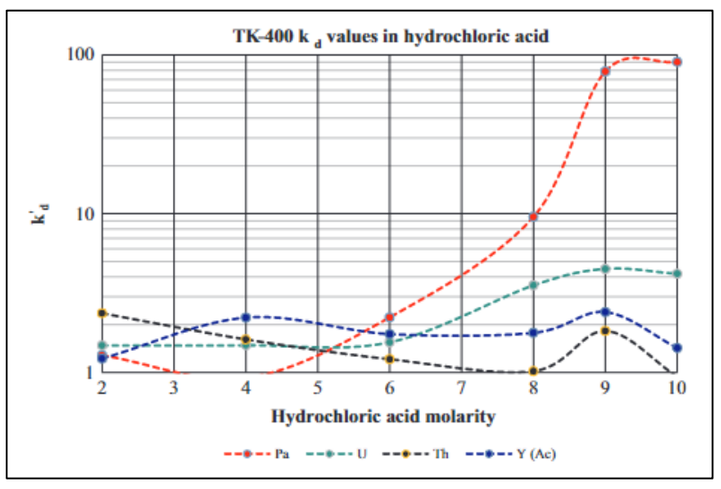
Half-life determination and comparison of activity standards of ^{231}Pa

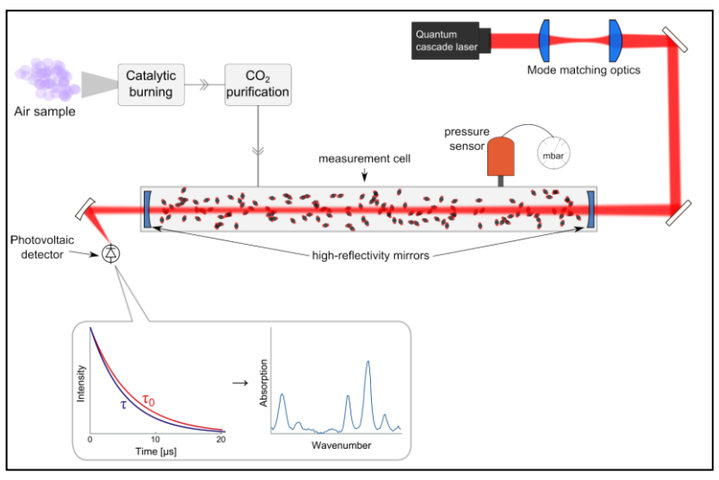
Simon Jerome[a,b,*,1], Christophe Bobin[c], Philippe Cassette[c], Rainer Dersch[d], Raphael Galea[c], Haoran Liu[f], Anja Honig[d], John Keightley[a], Karsten Kossert[d], Juncheng Liang[f], Maria Marouli[g], Carine Michotte[b], Stefaan Pommé[g], Stefan Röttger[d], Ross Williams[h], Ming Zhang[f]



TK400 resin distribution coefficients in HCl

Carbon-14 (5,700 (30) a)

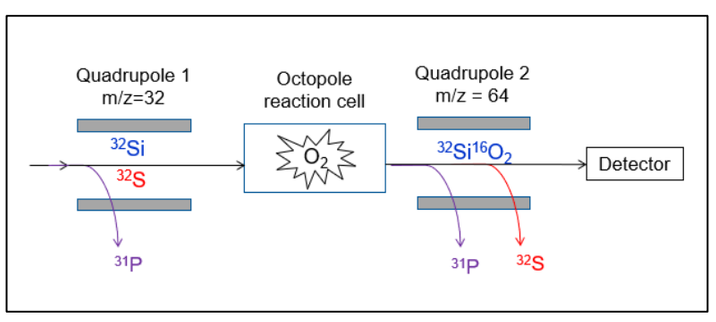
- PhD projects dedicated to development of IR-absorption laser spectrometry to overcome limitations of current LSC and AMS methods for ^{14}C.
- Will lead to improved measurement of fossil fuel fractions of CO_2 and CH_4.



IR laser spectrometry. Genoud et al. VTT

Silicon-32 (153 (19) a)

- Ambition to update half-life measurement as part of Sinchron Project.
- Atom counting using ICP-MS/MS.
- Combined with results from PSI, PTB and ETHZ.



ICP-MS/MS layout for ^{32}Si detection

EMPIR EURAMET The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States
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