Nuclear astrophysics constraining cosmology

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The destiny of the Universe is strongly coupled to the history of space and time. In particular the age of the Universe allows to constrain our models about the future. If the expansion of the Universe is accelerated it is currently older than if it would collapse again at some point in the distant future.

Nuclear astrophysics provides tools to determine the age of the Universe independent from astronomical observations. This history of the Universe is imprinted in the isotopic abundance pattern of stable and, in particular, long-lived unstable nuclei. If the half-life of such isotopes is comparable to the Hubble time, they can be interpreted as cosmo-chronometers.

A promising isotope is ^{87}Rb, which decays on a time scale of 50 Gyr to ^{87}Sr. The interpretation of this isotope as a cosmo-chronometer is currently hampered by the unknown neutron capture cross section of ^{85}Kr, which decays with a half-life of 10 yr. The measurement of this cross section will soon be possible at the FRANZ facility at the Goethe University Frankfurt/Germany, which is currently under construction.