Übung am 20.05.2010 zur VL "Astroteilchenphysik und Kosmologie", Aufgaben A und B aus Iliadis (2007)!

Webseite der Vorlesung:
http://www.fzd.de/pls/rois/Cms?pOid=30632&pNid=2041

A **5.12** Estimate the r-process contribution to the solar system abundance of the s,r-isotope ^{125}Te. Use values of $N_\odot(124) = 0.2319$ and $N_\odot(125) = 0.3437$ for the number abundances of ^{124}Te and ^{125}Te per 10^6 Si atoms, respectively (Lodders 2003). The Maxwellian-averaged neutron-capture cross sections at kT = 30 keV for ^{124}Te and ^{125}Te are $\langle\sigma\rangle_{124} = 155 \pm 2$ mb and $\langle\sigma\rangle_{125} = 431 \pm 4$ mb, respectively (Bao et al. 2000).

B **5.16** By using the waiting point and steady flow approximations of the r-process, calculate the half-life of ^{130}Cd from the measured half-lives (Audi et al. 2003) of ^{131}In ($T_{1/2} = 280 \pm 30$ ms) and ^{133}In ($T_{1/2} = 165 \pm 3$ ms) and from the observed solar system r-abundances (Anders and Grevesse 1989, Arlandini et al. 1999) of ^{130}Te (1.634), ^{131}Xe (0.946), and ^{132}Xe (0.748). The latter values are given relative to Si ($N_{\mathrm{Si}} \equiv 10^6$). Note that the measured branching ratio for the β-delayed neutron decay of ^{133}In amounts to $P_n = 85\%$ (Audi et al. 2003). Disregard all other β-delayed neutron decays (see Fig. 5.71).

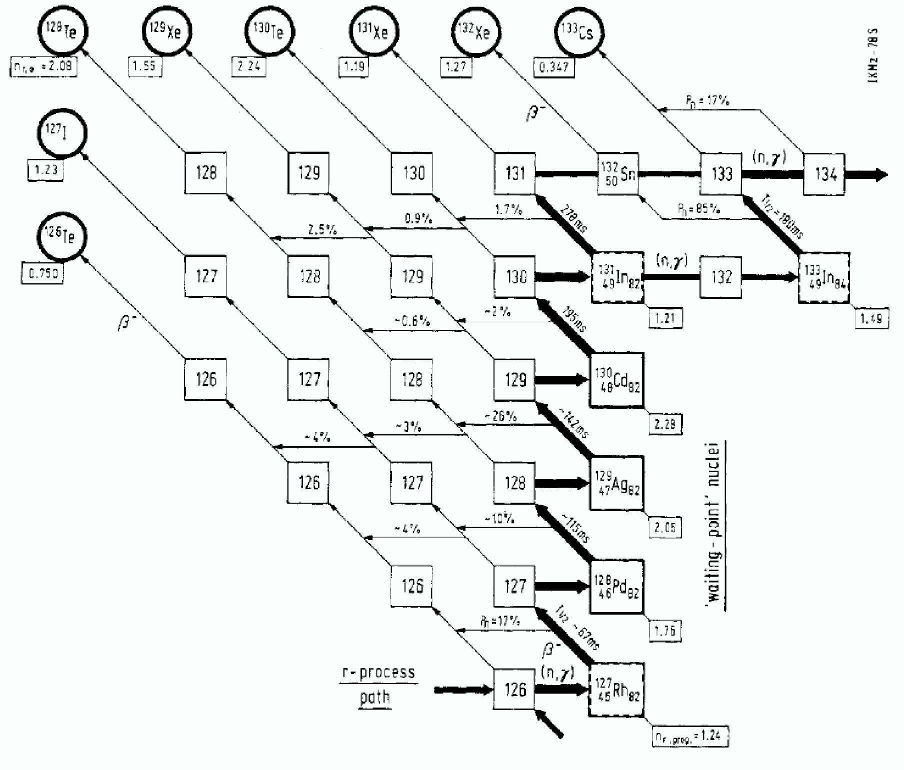

Fig. 5.71 Schematic r-process path near $A \approx 130$ and $N \approx 82$. Numbers near diagonal arrows represent β^--decay half-lives (in seconds) and those near horizontal arrows show branching ratios (in percent) for β-delayed neutron decay. The quoted values are adopted from experiment or, when preceded by "∼", from nuclear model calculations. Stable end products of the r-process (after freeze-out) are shown in circles and their observed solar system r-abundances are given in square boxes. More recent information on nuclear properties and abundances can be found in Audi et al. (2003), Möller, Nix and Kratz (1997), and Lodders (2003). Note that ^{130}Cd is the neutron magic waiting point nucleus with N = 82 that is located closest to stability. At the next element (indium), the r-process path branches off horizontally toward heavier nuclei (see the text). The nuclide ^{130}Cd is the progenitor of the stable isobar ^{130}Te which is situated at the maximum of the A = 130 peak in the solar system r-process abundance distribution. Reprinted with permission from K.-L. Kratz et al., J. Phys. G, Vol. 14, p. 331 (1988). Copyright (1988) by IOP Publishing Ltd.