Neutron-capture and the r-process

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R-process is a rapid neutron-capture process which formed about a half of elements heavier than iron in the nature. This process occurs on explosive event such as Type II supernovae, but nobody has been identified its astrophysical origin unambiguously.
Neutron capture reaction consists of two component, compound process and direct-capture process. The direct capture reactions are neglected in most of previous r-process studies although it has been pointed out that direct capture reaction become dominant around r-process path.
We studied a role of direct capture reaction in the r-process using dynamical network code. The direct capture makes freeze out earlier and changes final abundances drastically because neutron-capture reaction rates change the physical condition of freeze out. Systematic studies of neutron-capture reaction rates, based on experiments and theory are strongly desired.