CODE MCGNASH

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INTRODUCTION

MOTIVATION

- Need for evolution capability to easily upgrade the various Physics models
- Need for more predictivity $\Rightarrow$ more microscopic nuclear structure input and more accurate description of some reaction mechanisms (fission, pre-equilibrium processes...)

$\Rightarrow$ code GNASH rewritten in Fortran 95 and in a modular way by P. Talou: code McGNASH

MAIN ON-GOING EXTENSIONS

- DSD module for direct nucleon capture cross sections
- KKM module as an extension of Hauser–Feshbach
- Fission modeling
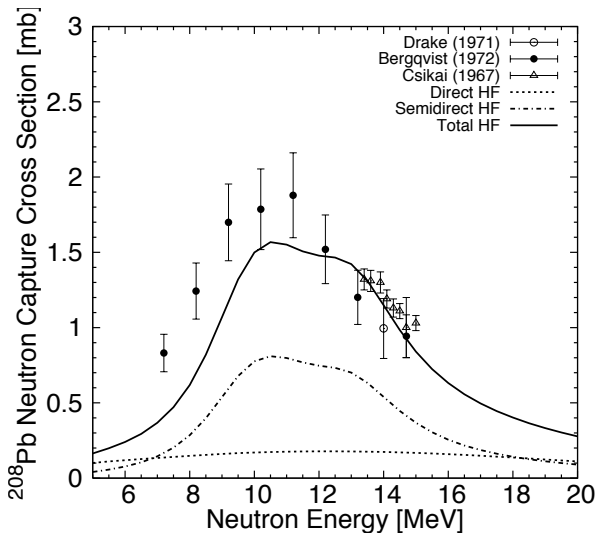
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DSD MODULE

DIRECT–SEMI-DIRECT MECHANISM

- Direct capture: direct electric dipole transition to a single-particle bound state
- Semi-direct capture: electric dipole transition to a single-particle bound state via GDR compound-nucleus states
- Bound states and spectroscopic factors calculated in the Skyrme–Hartree–Fock-BCS approach; single-particle spectrum shifted to reproduce experimental S_n (esp. in spherical nuclei)
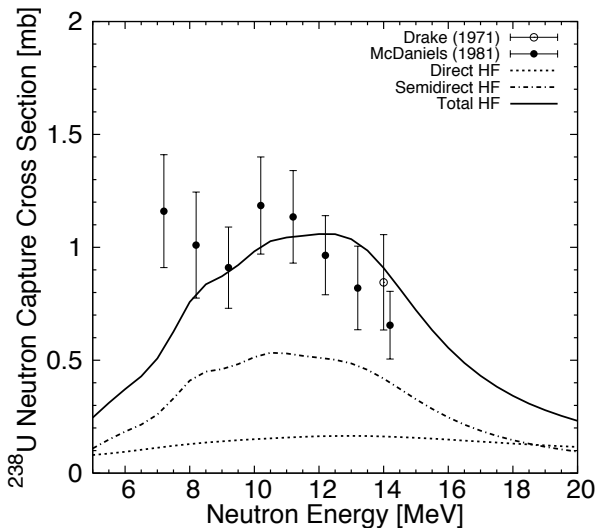
CODE DEVELOPMENT

- code originally in C, rewritten in Fortran 95
- interface with McGNASH in development
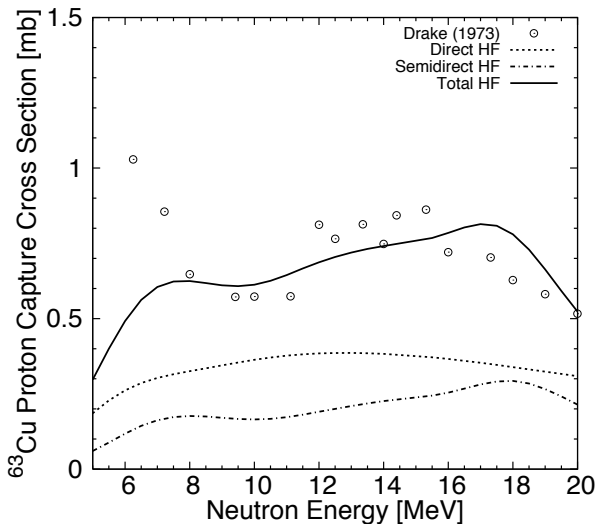- tested on ^{208}Pb+n, ^{238}U+n and ^{63}Cu+p: good results

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DSD CALCULATIONS: ^{208}Pb(n, γ)

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DSD CALCULATIONS: ^{238}U(n, γ)

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DSD CALCULATIONS: ^{63}Cu(p, γ)

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KKM MODULE

KAWAI-KERMAN-MCVOY THEORY

- coupling of open channels to direct channels in Hauser-Feshbach cross sections
- extension of Hauser-Feshbach theory to deformed nuclei

CODE DEVELOPMENT

- coupled-channels code extended to calculate a penetration matrix
- full KKM calculation will be done soon and presented at ND2007

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FISSION MODELING

- realistic fission barrier profiles (multi-humped, non-parabolic, multidimension and multimodal effects)
- damping through barriers could be described by multidimensional effects (inertia parameters)
- width fluctuation averaging factors (in collaboration with J.E. Lynn)
- level densities and transition states from microscopic nuclear structure models accounting for enhancements at barrier tops

CODE DEVELOPMENT

- new expressions for T_f to be derived
- interface with nuclear structure models through data files $\Rightarrow$ fewer input parameters in input files

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