FISSION BARRIERS OF EXOTIC NUCLEI

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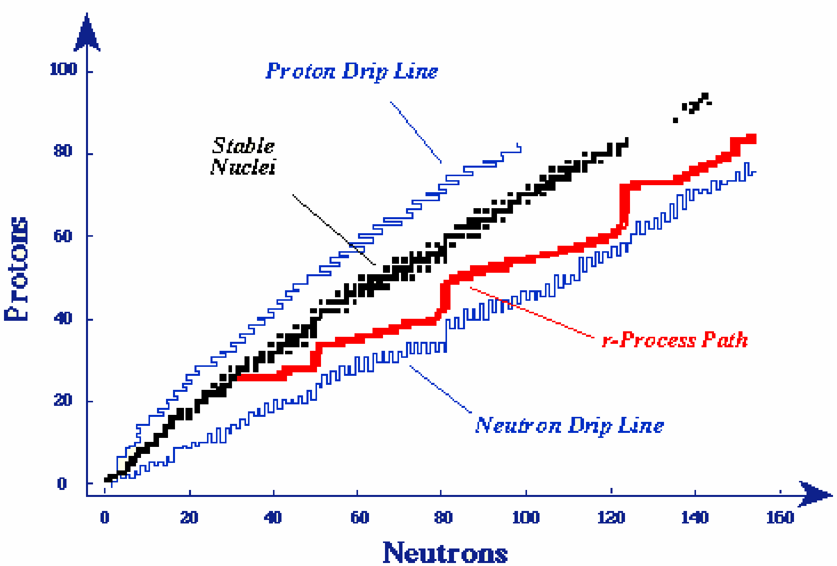
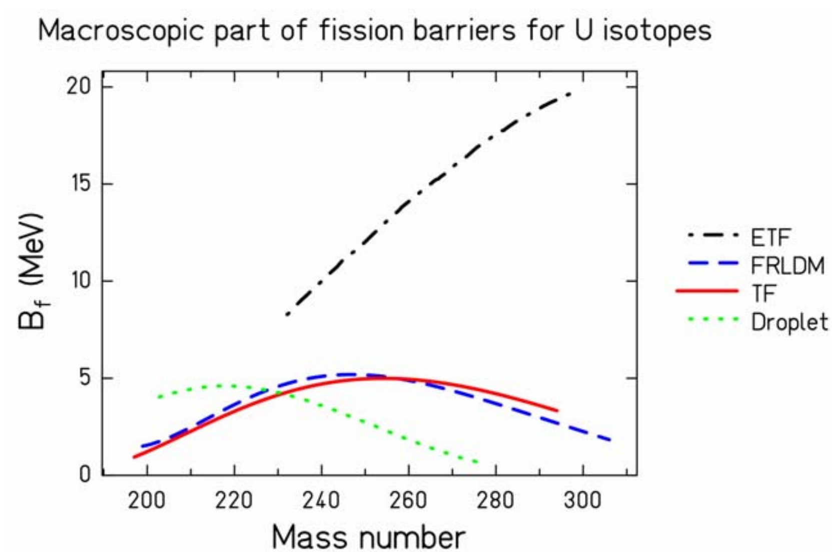
Motivation

- Limited experimental information on the height of the fission barrier ⇨ in any theoretical model the constraint on the parameters defining the dependence of the fission barrier on neutron excess is rather weak.

- This imposes a large uncertainty in estimating the fission barriers of exotic nuclei, which are relevant in some astrophysical scenarios, e.g. the r-process.

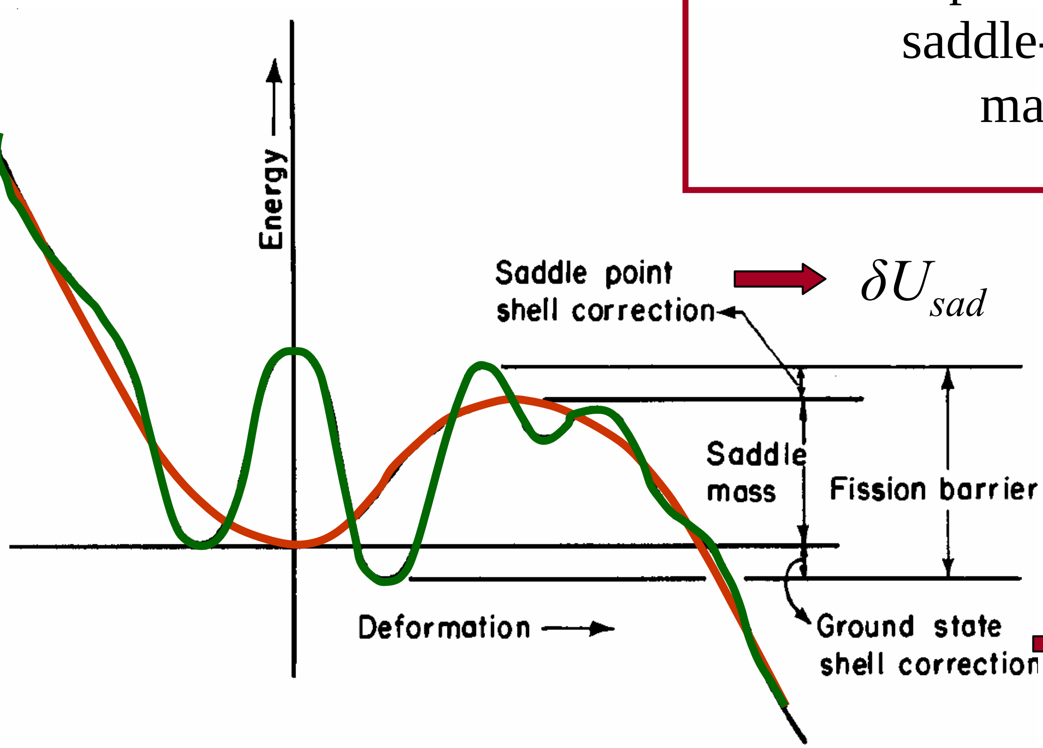




Idea

Predictions of theoretical models are examined by means of a detailed analysis of the isotopic trends of ground-state masses and fission barriers.

$$\delta U_{sad} = \underbrace{E_f^{\exp} + M^{\exp}}_{\text{Experimental saddle-point mass}} - (\underbrace{M^{macro} + E_f^{macro}}_{\text{Macroscopic saddle-point mass}})$$



δU_{sad}

E_f^{exp}

M^{exp}-M^{mod}

-Bjørnholm &Lynn, *Rev. Mod. Phys. 52*

-Dahlinger et al, *Nucl. Phys. A376*

Studied models

1.) **Droplet model** (DM) [Myers 1977], which is a basis of often used results of the Howard-Möller fission-barrier calculations [Howard&Möller 1980]

2.) **Finite-range liquid drop model** (FRLDM) [Sierk 1986, Möller et al 1995]

3.) **Thomas-Fermi model** (TF) [Myers&Swiatecki 1996, 1999]

4.) **Extended Thomas-Fermi model** (ETF) [Mamdouh et al. 2001]

W.D. Myers, *„Droplet Model of Atomic Nuclei“*, 1977 IFI/Plenum

W.M. Howard and P. Möller, *ADNDT 25 (1980) 219.*

A. Sierk, *PRC33 (1986) 2039.*

P. Möller et al, *ADNDT 59 (1995) 185.*

W.D. Myers and W.J. Swiatecki, *NPA 601(1996) 141*

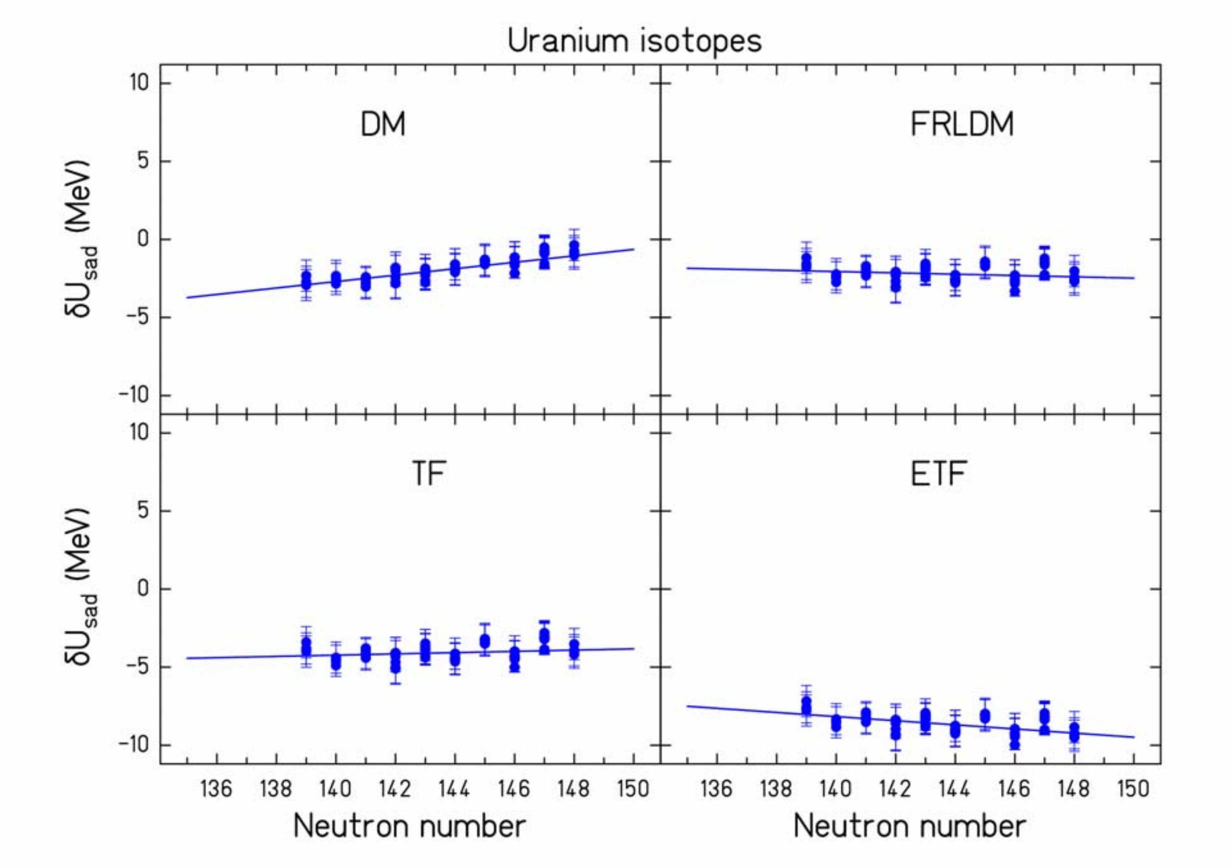
W.D. Myers and W.J. Swiatecki, *PRC 60 (1999) 0 14606-1*

A. Mamdouh et al, *NPA 679 (2001) 337*

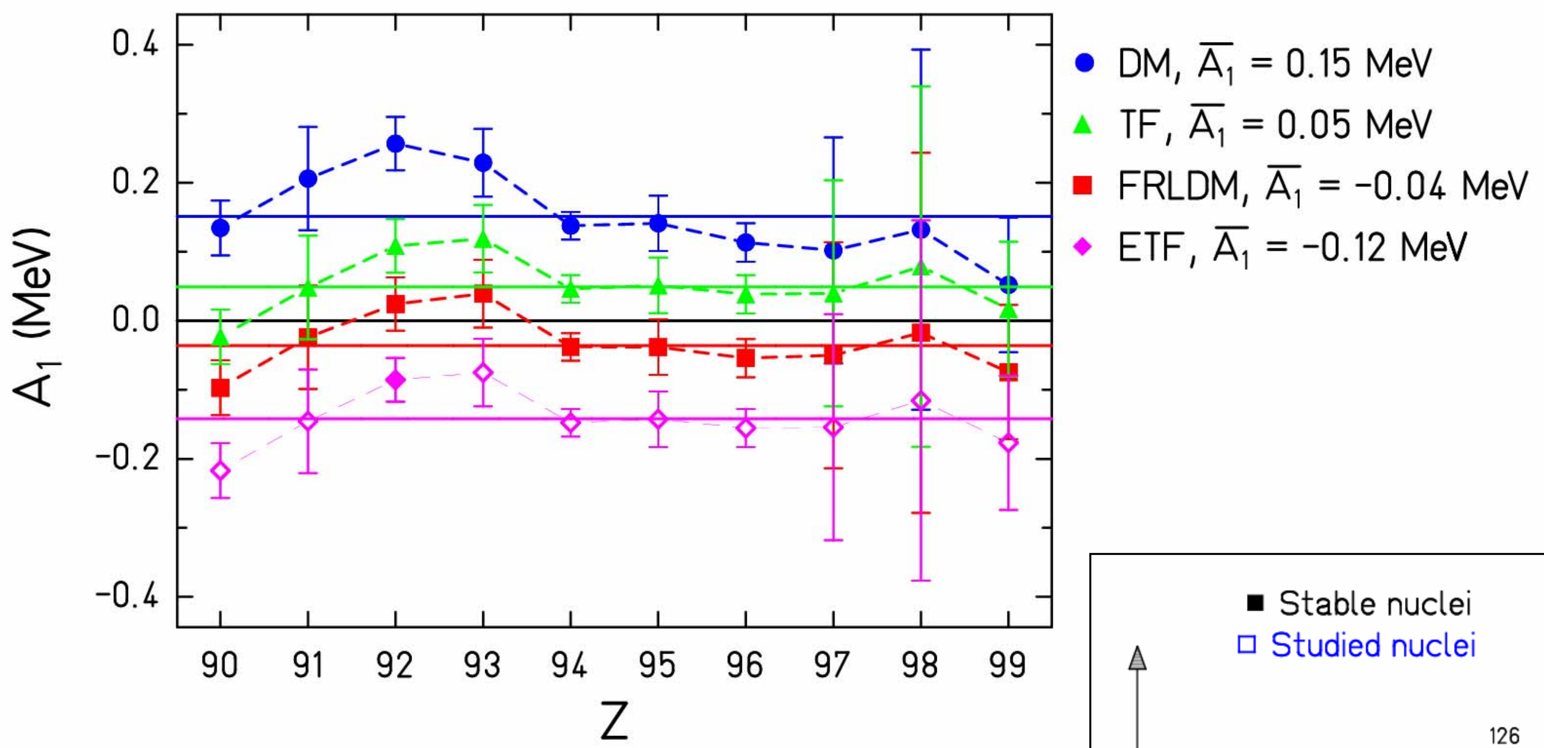
Results - U case

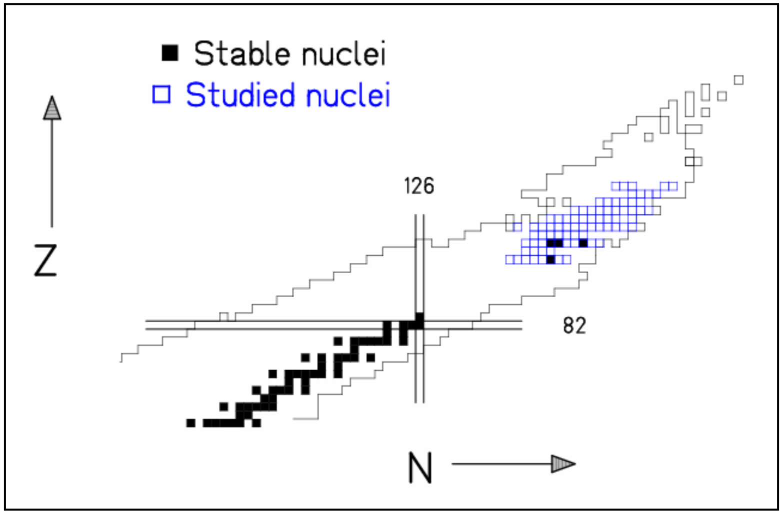
$$\delta U_{sad} = E_f^{\exp} + M^{\exp} - (M^{macro} + E_f^{macro})$$

→ Any general trend would indicate severe shortcomings of the model



Results - general





Conclusion

The results of this study show that the preferential models should be the finite-range liquid-drop model and the Thomas-Fermi model. Severe doubts in the consistency of the droplet model are seen. Similar indications for ETF.