# *Time Dependent Study of Shell Effects In Mass Transfer*

## *- The $^{136}Xe$ + $^{209}Bi$ (1130 MeV) Reaction -*

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We discuss the influence of shell structure effects on the mass transfer. Mass drift and -variances for the asymmetric $^{136}Xe$ + $^{209}Bi$ (1130 MeV) system are calculated.

Freiesleben and coworkers[1] considered quantitatively the consequences of shell effects on the nucleonic mass transfer by calculating the potential energy surface U for groundstate nuclei. The PES drives the particle transport by means of the following 'driving force'

$$V(A) = - D/T \; \partial_A U(A)$$

where D is the diffusion-coefficient and T the temperature of the system. We solve[2,3] the time dependent Fokker-Planck-Equation (FEP) for the probability f(A,t) to find a nuclear mass A at time t

$$\partial_t f(A,t) = \partial_A [ -v(A) + D\partial_A ] f(A,t)$$

and calculate the mean mass

$$\langle A \rangle = \int A \; f(A,t)dA$$

and the mass variance

$$\sigma_A = \int (A-\langle A \rangle)^2 \; f(A,t)dA \; .$$

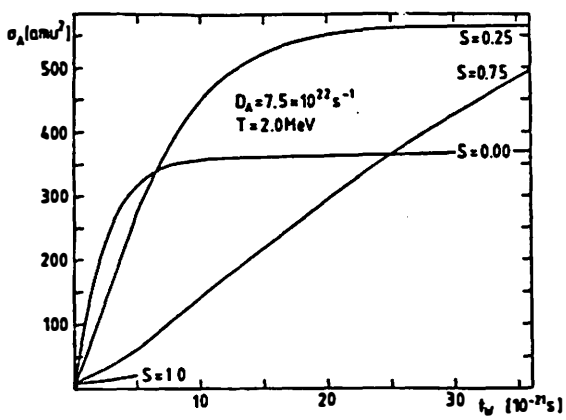
If one compares now the experimental mass distribution[4] with the calculated mass drift and variance one finds the following main insufficiences[5]:

a: Within the available interaction time it is impossible to reach the maximal experimentally observed mass variances. In that respect shell effects could be helpful (see fig. 1a) if they would be evident at high energy losses.

b: In the common FPE approach there is a strong proportionality between drift and diffusion leading to the following contradiction: Either one gets an acceptable variance with a too strong drift or one gets an acceptable drift with a far to small variance.

Both figures show this connection between drift and diffusion (variance) for different melting factors S clearly. S=1 means no shell structure and S=0 means full shell structure in the PES.

Can the use of different derived drift- and diffusion terms result in a better and systematic agreement between data and transport theories[7]?



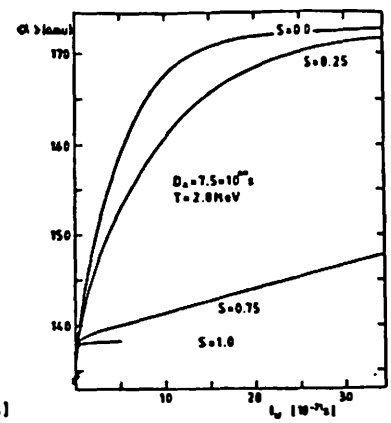




Fig. 1a: Mass variance $\sigma_A$ versus (interaction) time for different melting factors S. Diffusion coefficient D and Temperature T are fixed. The short (S=1) curve shows the maximal interaction time of a typical friction model1[6]

Fig. 1b: Mass drift <A> versus (interaction) time for different melting factors S.

*References*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