Variation of Transport Coefficients for Average Fission Dynamics with Temperature and Shape ◇

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We study slow collective motion at finite thermal excitations on the basis of linear response theory applied to the locally harmonic approximation. The transport coefficients for average motion, friction γ, inertia M and the local stiffness C are computed along a fission path of ^{224}Th within a quasi-static picture. The inverse relaxation time $\beta = \gamma/M$ and the effective damping rate $\eta = \gamma/(2\sqrt{M|C|})$ are found to increase with temperature, but do not change much with the collective variable. The values found for η and β as well as their behavior with temperature are in accord with experimental findings.

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Transport Coefficients for Shape Degrees in Terms of Cassini Ovaloids ◇

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Previous computations of the potential landscape with the shapes parameterized in terms of Cassini ovaloids are extended to collective dynamics at finite excitations. Taking fission as the most demanding example of large scale collective motion, transport coefficients are evaluated along a fission path. We concentrate on those for average motion, namely stiffness C, friction γ and inertia M. Their expressions are formulated within a locally harmonic approximation and the help of linear response theory. Different approximations are examined and comparisons are made both with previous studies, which involved different descriptions of single particle dynamics, as well as with macroscopic models. Special attention is paid to an appropriate definition of the deformation of the nuclear density and its relation to that of the single particle potential. For temperatures above $3\,MeV$ the inertia agrees with that of irrotational flow to less than a factor of two, but shows larger deviations below, in particular in its dependence on the shape. Also friction exhibits large fluctuations along the fission path for small excitations. They get smoothed out above $3 - 4\,MeV$ where γ attains values in the range of the wall formula. For $T \geq 2\,MeV$ the inverse relaxation time $\beta = \gamma/M$ turns out to be rather insensitive to the shape and increases with T.

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