Differences between AMD and FMD:

- Transition between two types of monopole vibrations for the narrow widths
- The time evolution of each Gaussian wave packet is given by:

\[ \frac{d\mathbf{Z}}{dt} = \frac{i}{\hbar} \mathbf{H} + \Delta \mathbf{Z}(t) + (\text{NN collisions}) \]

- Treatment of the center of mass motion

The table shows the physical frequencies where \( \nu^* \approx \nu \).

- The results are in good agreement with TDHF/RPA for \(^{4}\text{He}\) with SLy4
  - \( \nu^* \) (TDHF) = 22.15 MeV
  - \( \nu^* \) (RPA) = 21.55 MeV
- \( \nu^* \) increase with the incompressibility
  \( K_{\text{Ca}(\text{Gogny})} = 283\text{MeV} \)
  \( K_{\text{Ca}(\text{SLy4})} = 229.9\text{MeV} \)
  \( K_{\text{Ca}(\text{SIII})} = 353.4\text{MeV} \)
- The second frequency is more affected by \( K_{\text{Ca}} \) for the FMD case

Motion of the Gaussian wave packets in the phase space

- Only one type of monopole vibrations for the wide widths
- The frequencies decrease gradually with the amplitude
- Potential with a single minimum
- Transition between two types of monopole vibrations for the narrow widths
- The frequencies behave as if we have a potential with two minima

Other example with FMD

- Several frequencies can appear if the model is light and structurally clustered
- Example with \(^{20}\text{Mg}\) : Three frequencies (\( \nu^* = 16, 22 \text{ and } 25.5\text{ MeV} \))
- Three of these frequencies are seen to correspond with \( 3 \nu \), \( 2 \nu + \nu \) and \( \nu \)

Summary

- We studied the frequencies of the monopole vibrations for a wide range of amplitudes
- Interplay between the cluster structures and the monopole vibrations
- Only one mode is accessible for the AMD cases and a second frequency appears for the FMD case because of the width degree of freedom