Collisions of different discrete breathers

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Abstract:

Discrete breathers are localized vibrations in nonlinear discrete lattices. By perturbing them slightly in such a way that it breaks the phase symmetry the breathers become mobile. They radiate energy through phonons and eventually disappear. Nevertheless, they have long lives and conserve their shape and most of their energy during a long time. In Refs. [1,2] we have studied for systems with a Morse on-site potential two identical moving breather which collide either with the same or opposite phase, identical or different velocity. In Ref. [3] we have extended the study to systems with other on-site potentials as the sine-Gordon and ϕ^4.

In the present work the research is also focused on systems with Morse on-site potential but the collisions considered are between a moving breather and a stationary one and between two moving breathers travelling in the same direction but with different velocities, so that the faster reaches the slower. This scenarios are more appropriate for a real system as for example a DNA chain, where breathers can be a means for transporting energy and information, have been suggested as initiators of the transcription bubble and where breathing bubbles have been observed. When a moving breather interacts with a stationary one, the outcome may be reflection, generation of two breathers moving either in the same or in opposite directions. When a fast moving breather reaches a slower one the fast one overtakes the other with relatively minor changes, while the slower one becomes pinned to the lattice, or jumps back and then continues its path or, finally, starts moving in the opposite directions.

References:

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3.- A. Alvarez, F. R. Romero, J. Cuevas and J. F. R. Archilla, Eur. Phys. J. B, 70, 543 (2009).