

## **Many-body dynamics of bound pairs in the Bose-Hubbard model**

For sufficiently large interaction energies  $U$ , localized pairs of interacting bosons (dimers) in a periodic lattice can become meta-stable with respect to dissociation into pairs of separated particles (monomers). An effective many body theory for dimers is derived for the case of monomer vacuum and the phase diagram for the lowest dimer-like energy eigenstate is discussed. To leading order in  $t/U$ , with  $t$  being the hopping matrix element, the effective theory is equivalent to the ferromagnetic or antiferromagnetic XXZ model in an inhomogeneous magnetic field and with a large anisotropy parameter. For larger values of  $t/U$  the decay of dimers into monomers becomes relevant. An effective Liouvillian is derived for this process which is nonlinear and thus can lead to interesting phenomena such as the generation of intermediate entangled states.