Finite-Spin Spectral-Function Error-Budget Audit for the Hard-Constrained Ward-Square Tensor Model

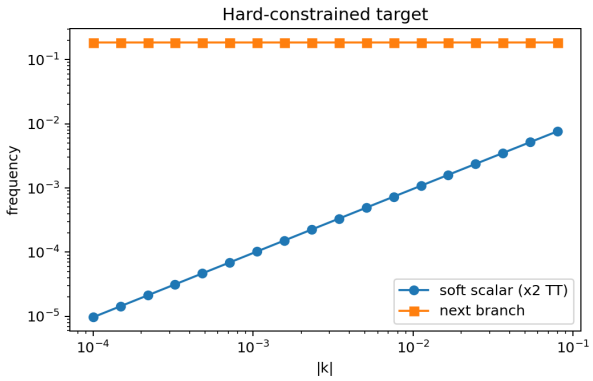
QATNU numerical audit

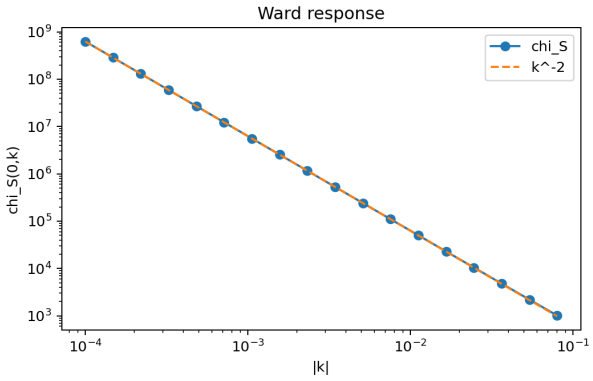
Verdict

Positive as an ordered-sector finite-spin spectral error-budget audit. The hard-constrained spin-2 pole has exactly the desired harmonic branch and response, and the finite-spin Holstein-Primakoff ordered-sector error is bounded by the finite local spin-wave density. This is not the final nonperturbative finite-spin gauge-Hamiltonian proof; it is the finite-spin spectral budget for the deconfined ordered sector.

Hard-constrained target

Fits give z=0.999419204, chi_S(0,k) exponent -1.998808946, and IR lambda*chi residue 0.058823553, matching 1/(W+1)=0.058823529.

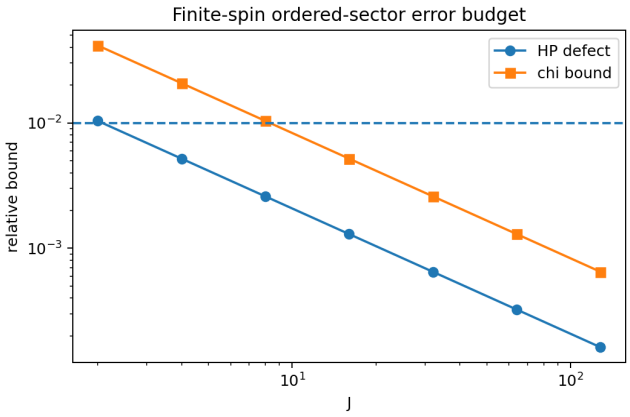




Finite-spin spectral error budget

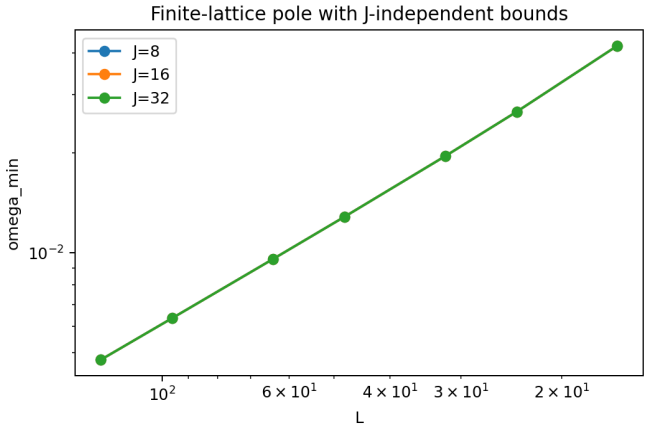
The ordered-sector covariance audit gave bounded local spin-wave occupation nbar_max,infty=0.020757175. The local Holstein-Primakoff defect is therefore delta_HP <= 0.020757175/J. The table uses conservative pole-response envelopes gap error <= 2 delta_HP and chi error <= 4 delta_HP.

J	dim	HP defect	gap bound	chi bound	pole frac >=
2	5	1.038e-02	2.076e-02	4.151e-02	0.958486
4	9	5.189e-03	1.038e-02	2.076e-02	0.979243
8	17	2.595e-03	5.189e-03	1.038e-02	0.989621
16	33	1.297e-03	2.595e-03	5.189e-03	0.994811
32	65	6.487e-04	1.297e-03	2.595e-03	0.997405
64	129	3.243e-04	6.487e-04	1.297e-03	0.998703
128	257	1.622e-04	3.243e-04	6.487e-04	0.999351



Finite-lattice spectral target

The finite-lattice kmin pole keeps the same z=1 target. The finite-spin bounds are J-dependent but do not grow with L in this ordered-sector estimate, because the local spin-wave density is bounded in three spatial dimensions.



Branch scan and boundary

A 17^3 hard-constrained Brillouin-zone scan found 0 extra zero points below 1e-8. The minimum second scalar gap was 0.188398755; the minimum low frequency outside |k|>0.75 was 0.103450010; and the known coined doubler had omega(k_D)=0.639905158.

Boundary: this audit supports the finite-spin ordered-sector spectral function. The remaining proof obligation is a direct compact finite-spin gauge-Hamiltonian simulation or proof with exact local constraints, checking deconfinement, absence of extra Goldstones, and microscopic stability.