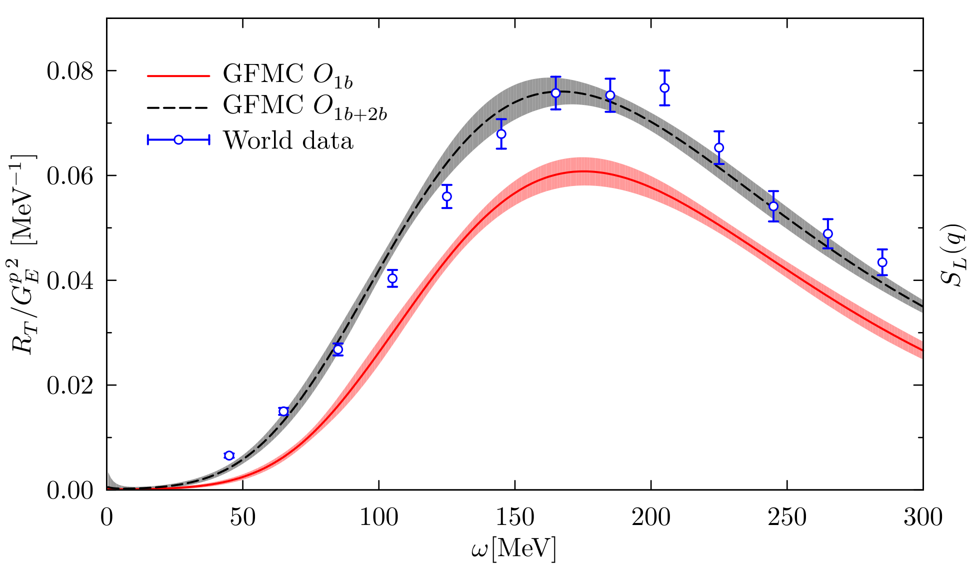
Electromagnetic response of ^{12}C: a first-principles calculation

Objectives

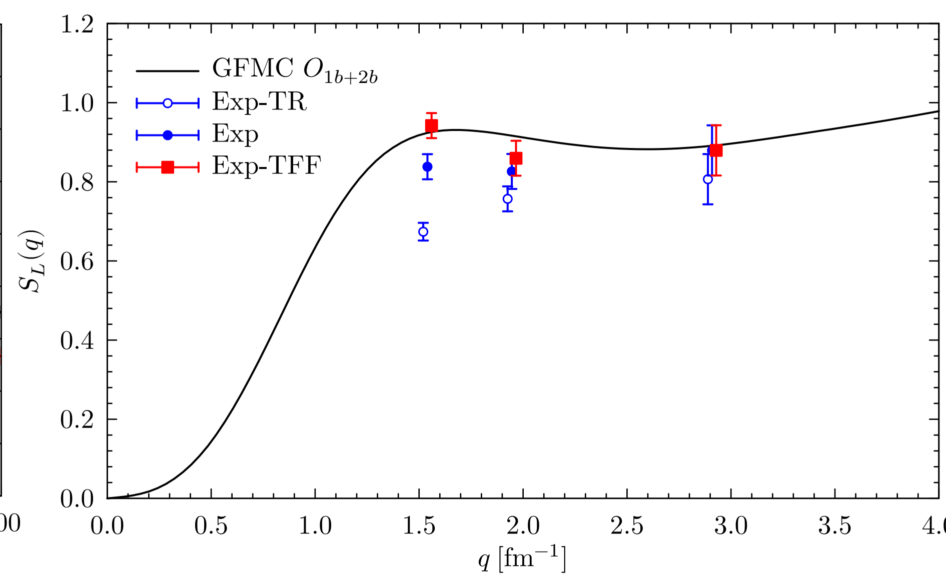
- Compute the electromagnetic longitudinal and transverse response functions of ^{12}C for which accurate experimental data are available.
- Investigate the energy dependence of the two-body meson-exchange currents contributions.
- Assess the in-medium modification of the proton electric form factor.

Impact

- The calculations of the response function of ^{12}C can be used to predict the results of the latest electron-^{12}C scattering experiment of JLab.
- Accurate calculations of electroweak response functions are crucial to neutrino-nucleus scattering experiments.
- Confirming or ruling out the quenching of the proton electric form factor also impacts the EMC effect and polarization transfer reactions.



Electromagnetic transverse response functions of ^{12}C for q = 570 MeV. Two-body currents increase the one-body response in both the quasielastic and threshold regions, bringing theory in good agreement with experiment.



Coulomb sum rule in ^{12}C. Good agreement with experiments (with no quenching of the proton electric form factor) if the transitions to, to the 2+, 0+2 (Hoyle), and 4+ states are accounted for.

Accomplishments

- Using DMEM and ADLB libraries we capitalized on the 50 million core hours granted by an INCITE award to reliably invert the Euclidean electromagnetic responses of ^{12}C.
- Two-body currents significantly enhance the transverse response.
- No quenching of the proton electric form factor is needed to reproduce the Coulomb sum rule when all the transitions to low-lying states of ^{12}C are accounted for.

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NUCLEI — Nuclear Computational Low-Energy Initiative

References: arXiv:1605.00248 (PRL in press)

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