The $2p - 2h$ electromagnetic response in the quasielastic peak and beyond

A. De Pace M. Nardi W. M. Alberico Istituto Nazionale di Fisica Nucleare, Sezione di Torino and Dipartimento di Fisica Teorica, via Giuria 1, I-10125 Torino, Italy T. W. Donnelly Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, MA 02139, USA A. Molinari Istituto Nazionale di Fisica Nucleare, Sezione di Torino and Dipartimento di Fisica Teorica, via Giuria 1, I-10125 Torino, Italy

abstract The contribution to the nuclear transverse response function $R_T$ arising from two particle-two hole $(2p-2h)$ states excited through the action of electromagnetic meson exchange currents (MEC) is computed in a fully relativistic framework. The MEC considered are those carried by the pion and by $\Delta$ degrees of freedom, the latter being viewed as a virtual nucleonic resonance. The calculation is performed in the relativistic Fermi gas model in which Lorentz covariance can be maintained. All $2p-2h$ many-body diagrams containing two pionic lines that contribute to $R_T$ are taken into account and the relative impact of the various components of the MEC on $R_T$ is addressed. The non-relativistic limit of the MEC contributions is also discussed and compared with the relativistic results to explore the role played by relativity in obtaining the $2p-2h$ nuclear response.