Breakdown of the impulse approximation and its consequences

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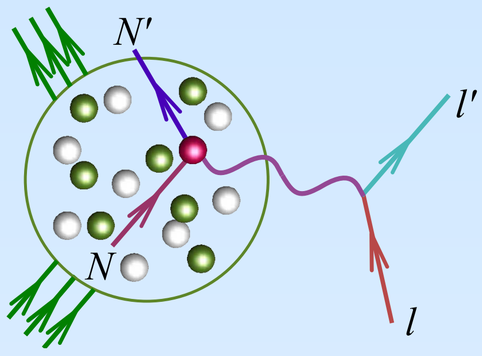
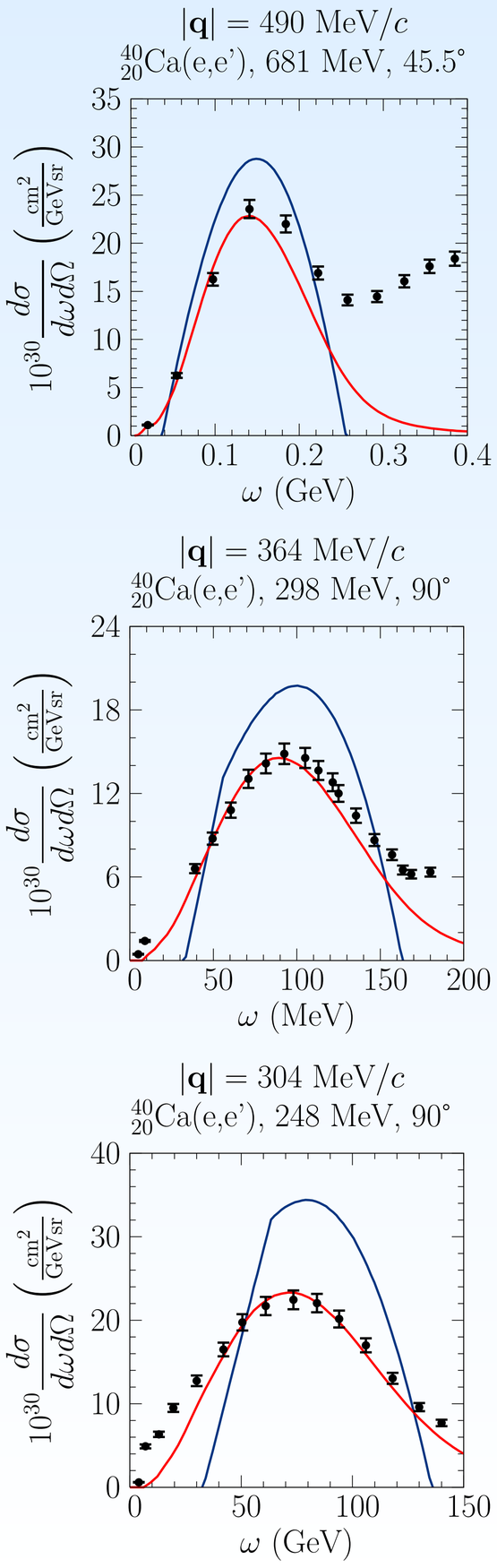
Impulse approximation

Only **one nucleon interacts**, all the other are spectators.



Electron scattering

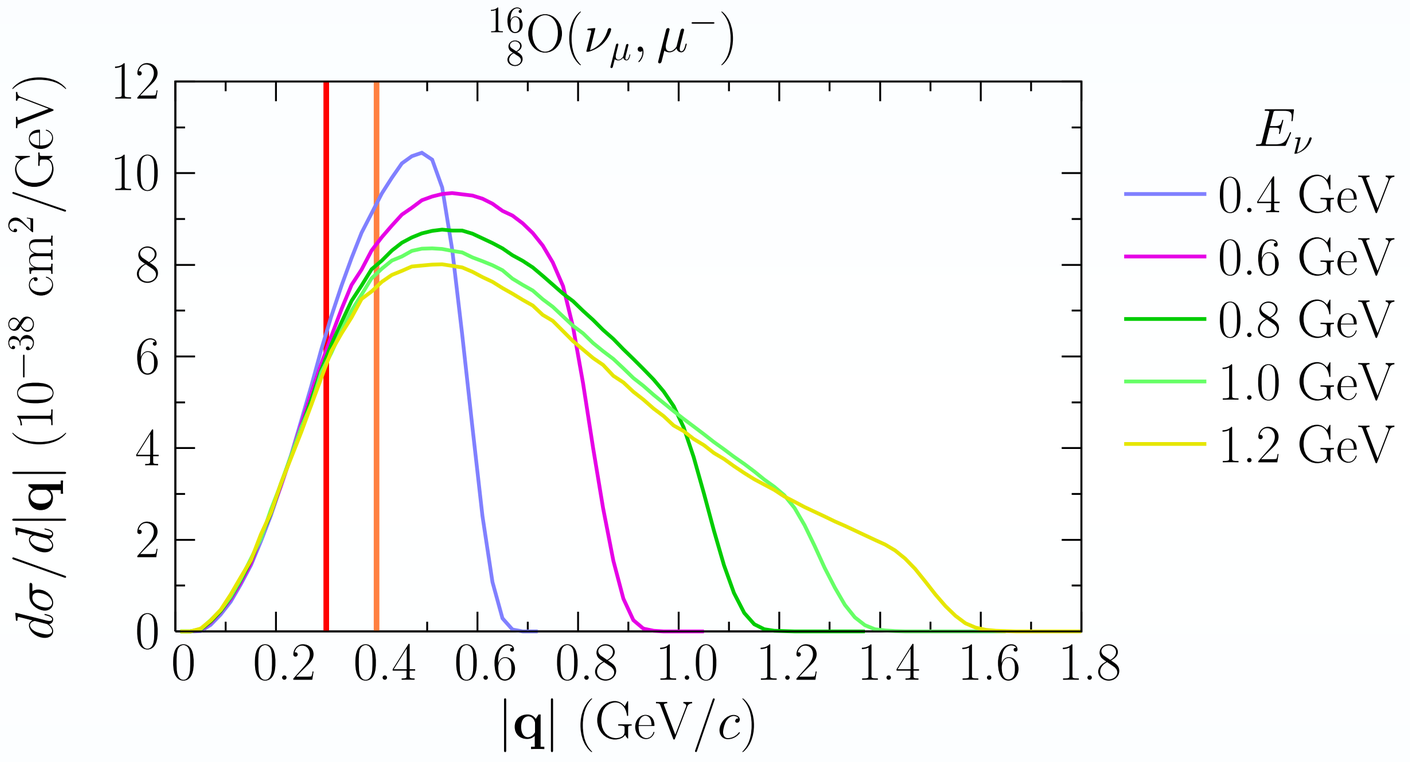
Spectral function [1] vs. **Fermi gas** and **data** [2], **only QE scattering**



Breakdown of the impulse approximation

From electron scattering one knows (see the frame on the right) that the impulse approximation works well when momentum transfer $|\mathbf{q}| \gtrsim 400$ MeV/c and **obviously fails below 300 MeV/c**.

Consequences for neutrino scattering



Low-$|\mathbf{q}|$ contribution to the ν cross section

	Neutrino energy (GeV)						
	0.2	0.4	0.6	0.8	1.0	1.2	1.4
$\lvert\mathbf{q}\rvert \leq 300$ MeV/c	97.2%	18.9%	11.9%	10.1%	9.4%	9.1%	9.0%
$\lvert\mathbf{q}\rvert \leq 400$ MeV/c	100.0%	43.3%	26.2%	21.6%	19.8%	19.1%	18.8%

In the energy region ∼1 GeV, we can be sure **only ∼80–90%** of the cross section obtained using the spectral function and even **less for the Fermi gas model**.

Details: Phys. Rev. C 77, 044311 (2008)

References

[1] A. M. Ankowski i J. T. Sobczyk, Phys. Rev. C **77**, 044311 (2008).

[2] C. F. Williamson *et al.*, Phys. Rev. C **56**, 3152 (1997).

Acknowledgement

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