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Spectral Weight Oracle: Model-Independent Sum Rule Analysis Based on Limited-Range Spectral Data ALEXEY KUZMENKO, DIRK VAN DER MAREL, FABRIZIO CARBONE, University of Geneva, FRANK MARSIGLIO, University of Alberta — Partial sum rules are widely used in physics to separate low- and high-energy degrees of freedom of complex dynamical systems. Their application, though, is challenged in practice by the always finite spectrometer bandwidth and is often performed using risky model-dependent extrapolations. We show that, given spectra of the real and imaginary parts of any causal frequency-dependent response function (for example, optical conductivity, magnetic susceptibility, acoustical impedance etc.) in a limited range, the sum-rule integral from zero to a certain cutoff frequency inside this range can be safely derived using only the Kramers-Kronig dispersion relations without any extra model assumptions. This implies that experimental techniques providing both active and reactive response components independently, such as ellipsometry in optics or simultaneous measurement of attenuation and speed of sound in acoustics, allow an extrapolation-independent determination of spectral weight 'hidden' below the lowest accessible frequency.

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