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Accurate Solution of the Comptonization in X-ray Reflection Models

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A large fraction of accreting black hole systems present clear evidence of the reprocessing of X-rays in the atmosphere of the accretion disk. The copious X-rays produced in the vicinity of a black hole illuminate the disk and produce a reflection spectrum which main hallmarks include fluorescent emission K-shell lines from iron (~6.4-6.9 keV), and a broad featureless component known as the "Compton hump" (~20-40 keV). The latter is produced by the scattering of high energy photons by the relatively colder electrons in the accretion disk, in combination with photo-electric absorption from iron. Until now, the treatment of this process in models of ionized X-ray reflection has been done in a very approximate manner using a Gaussian redistribution kernel. This approximation works sufficiently well up to ~100 keV, but it becomes largely inaccurate at higher energies and at relativistic temperatures. Here we report new calculations of X-ray reflection using a modified version of our model XILLVER, which now includes an accurate solution Compton scattering of the reflected photons in the disk atmosphere. This solution takes into account quantum electrodynamic and relativistic effects allowing the correct treatment of high photon energies and electron temperatures. We present new reflection spectra computed with this model, and discuss the improvements achieved in reproducing the correct shape of the Compton hump, as well as the effects of this new solution at softer energies.

Topic

Active Galactic Nuclei: accretion physics and evolution across cosmic time

Affiliation

Primary author: GARCÍA, Javier (Caltech & Remeis Observatory)

Co-authors: SOKOLOVA-LAPA, Ekaterina; MADEJ, Jurek; ROZANSKA, Agata; HARRISON, Fiona; WILMS, Jörn

Presenter: GARCÍA, Javier (Caltech & Remeis Observatory)

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