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Moving corona and the relativistic broad iron emission line

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Iron fluorescence emission lines from X-ray binaries and active galactic nuclei are important diagnostic tools for studying the physical processes near the event horizon of both the stellar-mass black holes in X-ray binaries and the supermassive black holes in active galactic nuclei. In this work, we investigate the line profile of the relativistic broad iron lines from the cool accretion disk of a black hole due to the asymmetric illumination of a moving corona, which moves away from the disk with a relativistic velocity. Both the off-axis location and the radial velocity of the moving corona are considered. Our results clearly show that the illumination and the line profile are dependent on the position and velocity of the corona, since the disk region below the corona receives more flux, which is the most important factor affecting the line profiles. As expected, if the corona is close to the receding part of the rotating disk, the red peak is enhanced, while the blue peak is weakened in the broad line profile, and the central energy of the emission line is low. Conversely, if the corona is close to the approaching part of the disk, the blue peak is strong and the central energy of the emission line is high, even higher than the intrinsic energy of the emission line. Due to the beaming effect of the moving corona, the corona with high velocity illuminates the outer region of the disk, which leads to the red peak disappearing and there being only one blue peak in the profile of the emission line.

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