

A TWO-COMPONENT REVERBERATION MODEL FOR THE TIME-DEPENDENT BROAD H β PROFILE

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ABSTRACT

Broad emission-line variability in active galactic nuclei provides a direct probe of the geometry and kinematics of the broad-line region (BLR). We present a semi empirical, profile-resolved reverberation model that follows the time dependent evolution of the broad H β line after a single ionizing flare. The BLR is represented by two components: a flattened Keplerian disk-like region, which produces the velocity-structured wings, and a more velocity dispersed Gaussian-like cloud component, which contributes mainly to the line core. The flare is treated as a propagating perturbation, launched either centrally or from an off-centre position. The model constructs the line profiles in the observer frame. Thus, a profile seen at a given epoch is not an intrinsic snapshot of the BLR, but a retarded-time superposition of emission from regions with different light travel delays and line of sight velocities. The simulations therefore predict both the profile evolution and the associated velocity-resolved reverberation pattern. The results show that a two component BLR, driven by a single propagating flare, can reproduce the stages of the observed profile variability. This approach provides a physical framework for studying broad-line profile variability and velocity resolved reverberation in AGN monitoring data.