Anisotropy BLR

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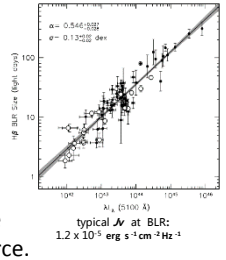
Abstract

We study the impact of the inclination angle on the Broad Line Region(BLR) when it suffers an anisotropic central ionization source. We use Cloudy to derive the relationship between intensity and radiative pressure, and find out that sphere symmetric is not longer proper in high accretion rate conditions.

Introduction

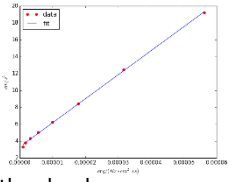
R-L relationship:
the light variation time lag between emission line and continuum is proportional to the scale of BLR.
Usually a BLR is considered as a group of clouds with sphere symmetric structure caused by an isotropic source.



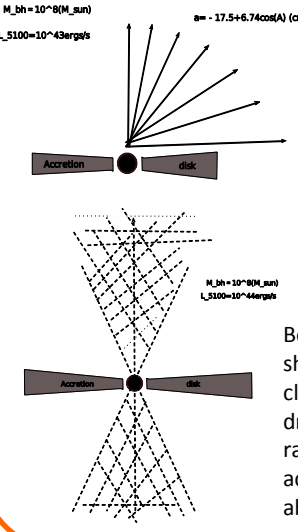
We assume an anisotropic central ionization source (disk)--- near the polar region the accelerate rate is largest, and don't average the effect, to research what R-L relationship actually means.

Intensity-Radiative Pressure Relationship

The intensity of the cloud is inverse ratio to square of radius and continuum luminosity. With the relationship and a BLR distribution function, we can study the dynamics of the clouds. Using Cloudy can easily work out the relationship. The figure is for clouds in Hβ region.



BLR dynamics



Top panel: Anisotropic total acceleration through angles at typical radius derived from R-L relationship, accretion rate is about 0.01L_{edd}

Bottom panel: In shadow area all clouds will be driven away by radiative pressure, accretion rate is about 0.1L_{edd}

Conclusion and Future Work

We exploit Cloudy to obtain the acceleration of gas in Broad Line Region driven by the radiative force of continuum. Then we roughly estimate the dynamics of BLR, and find out that the sphere symmetric have been broken in high accretion rate. In future we will calculate the dynamics carefully and try to find a formation mechanism for BLR. In addition, we will test the BLR dynamics in disk self-shadowing conditions.

References

Li et al 2010
Bentz et al. 2013