MODELS OF EMISSION LINE REGIONS AROUND CENTRAL CLUSTER GALAXIES

A. C. S. Friaça
Instituto Astronômico e Geofísico - U.S.P.
C.P. 9638, 01065 São Paulo, S.P. - Brasil

ABSTRACT. Hydrodynamical time-dependent models allows to follow the evolution of condensations in cooling flows until the phase of optical line emission.

The line emission flux ratio [NII]λ6583/Hα would allow to divide the optical filaments of cooling flows into two quite distinct classes, class I with $<$[NII]/H$\alpha >$ = 2.0 , and class II with $<$[NII]/H$\alpha >$ = 0.9 (Heckman *et al.* 1989). In this work we consider time-dependent models for the optical filaments including the effects of shocks and photoionization by soft X-rays produced in the cooling gas as well as by an OB star population formed in the cooling flow.

The evolution of the cooling condensations is obtained by time-dependent hydrodynamical calculations. The ionization state of the gas is obtained by solving the ionization equations during each time step using the code SUMA (Viegas-Aldrovandi and Contini 1989). When compared to the observations, the pure shock models give inconsistent ration lines and too weak luminosities. Therefore, two classes of models were built including the photoionization by the soft X-rays produced in the surrounding cooling flow: the class A models were applied to A1795 (host of class II filaments) at r = 20 kpc and the class B models to A496 (host of class I filaments) at r = 3 kpc. The values of the local X-ray flux and of the mass removal efficiency are derived from evolutive models for the cooling flows of A496 and A1795 (Friaça 1991). In class A models, we have also included the photoionization by a OB star population formed in the condensation. As a result, $L_{H\alpha}$ is greatly increased. The ratio for the [NII] emission is typical of class II filaments, and the other line ratios are also consistent with this class. Only a star formation efficiency much less than 10 % is required to fuel the low luminosity of the extended filaments, far from the center. In class B models, $L_{H\alpha}$ is not much increased, but it is adequate to class I filaments, and the derived [NII] line ratio has the correct value for this class. On the other hand, the higher X-ray flux in cooling flows with class II filaments could allow that also models with photoionization by only the ambient soft X-rays may be applicable to this class.

REFERENCES

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