MATTER–BOUNDED PHOTOIONIZED CLOUDS

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The *extended* ionized gas in Seyfert and Radio-Galaxies is characterized by large values of the ratio He II/Hβ, which exceeds the value predicted by the standard photoionization model in which the ionizing continuum consists of a power-law. This has lead to the suggestion of considering a matter-bounded (MB) component [3],[5],[2] for explaining such extreme values. We now find[1] that it is also possible to resolve the temperature problem[3] if the thickness and the ionization parameter of the MB is appropriately selected. Adopting a canonical power law (α=$-$1.3) and solar abundances (Z=1), we can account for the observed trends in excitation (represented for example by the ratio [O II]/[O III] in Fig. 1)) by varying the relative number of MB clouds (which emit the high excitation lines C IV, [Ne V], He II... and most of [O III]) versus the number of ionization-bounded (IB) clouds (which emit [N II],[S II] [O II], [O I]...). We obtain a one-parameter sequence (solid line) which is function of the weight $A_{M/I}$ of the MB component relative to the IB component. This $A_{M/I}$–sequence successfully reproduces the observed range in He II/Hβ. Note the failure of the traditional U–sequence (long dashed line). Fig. 2 indicates that we can also reproduce the ratio R_{OIII}= [O III]λ4363/[O III]λ5007 and therefore resolve the temperature problem. Interestingly, our model indicates a temperature difference of 5 000 K between the IB component ([N II] temperature $\simeq$ 10 000 K) and the MB component ([O III] temperature $\simeq$ 15 000 K) while the traditional U–sequence predicts a difference of only 1 000 K. Such difference of 5 000 K has been reported[4] in the extended gas of Cygnus A.

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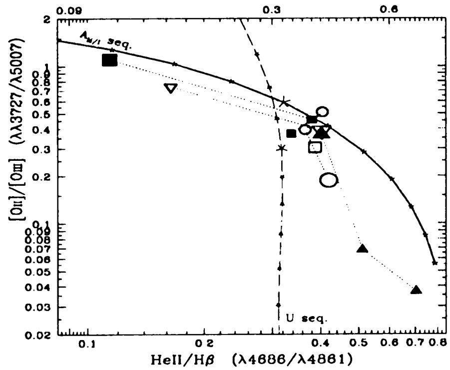

Figure 1. Diagram of the line ratios [O II]/[O III] against He II/Hβ. Filled and open symbols denote Seyfert and radio galaxies, respectively. Larger symbols denote the nuclear values. A dotted line joins measurements at different locations in the same galaxy. The parameter $A_{M/I}$ of our model represents the relative weight of the MB component and *increasases* from left to right along the solid line ($0.04 \leq A_{M/I} \leq 16$). The long dashed line represents the traditional U–sequence.

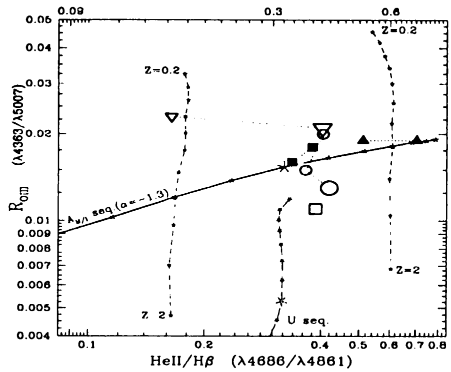

Figure 2. Diagram of the line ratios R_{OIII} (4363Å/5007Å) against He II/Hβ. The symbols have the same meaning as in Fig. 1. $A_{M/I}$ is *increasing* from left to right. The two short-dash lines correspond to metallicity sequences ($0.2 \leq Z \leq 2.0$) at $A_{M/I}$=0.4 and 4.0.

References

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