Line Broadening in O-type Stars: Microturbulence or an Outflow Velocity Gradient?

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We have recently found strong evidence for microturbulence in the photosphere of the sdO star BD +75° 325 (Hubeny, Heap, and Altner, 1991, Ap. J. Letters, 377, L33). This result suggests that microturbulence may play a much more important role in the atmospheres of early-type stars than previously believed, and may help to resolve the longstanding discrepancy between evolutionary and spectroscopic masses. In this same paper we reported indirect evidence for microturbulence in the O3f star Melnick 42, although in this case it is not clear whether microturbulence or a systematic velocity gradient is responsible for the observed broadening, since this star, like other O stars, has a strong wind.

To explore this question further we have developed a computer program which calculates synthetic photospheric spectra for a given model atmosphere, taking into account the effects of both microturbulence and a stellar wind. Given our assumption of plane-parallel geometry, these calculations are applicable to the weak and moderately strong metal lines formed in the photosphere and in the region around the sonic point, but are inappropriate for profiles of the strong UV resonance lines formed in the highly supersonic part of the wind. Here we report preliminary results which indicate that using high-resolution UV spectra one may indeed disentangle the effects of microturbulence from those of mass outflows by simultaneously observing lines of different intrinsic strengths and species with different atomic weights.