High resolution X-ray spectroscopy of bright O type stars

L.M. Oskinova, A. Feldmeier, W.-R. Hamann

University Potsdam

Archival X-ray spectra of the four prominent single, non-magnetic O stars Zeta Pup, Zeta Ori, Ksi Per and Zeta Oph, obtained in high resolution with Chandra HETGS/MEG have been studied. The resolved X-ray emission line profiles provide information about the shocked, hot gas which emits the X-radiation, and about the bulk of comparably cool stellar wind material which partly absorbs this radiation. In this paper, we synthesize X-ray line profiles with a model of a clumpy stellar wind. We find that the geometrical shape of the wind inhomogeneities is important: better agreement with the observations can be achieved with radially compressed clumps than with spherical clumps. The parameters of the model, i.e. chemical abundances, stellar radius, mass-loss rate and terminal wind velocity, are taken from existing analyses of UV and optical spectra of the programme stars. On this basis, we also calculate the continuum-absorption coefficient of the cool-wind material, using the Potsdam Wolf-Rayet (PoWR) model atmosphere code. The radial location of X-ray emitting gas is restricted from analysing the fir line ratios of helium-like ions. The only remaining free parameter of our model is the typical distance between the clumps; here, we assume that at any point in the wind there is one clump passing by per one dynamical time-scale of the wind. The total emission in a model line is scaled to the observation. There is a good agreement between synthetic and observed line profiles. We conclude that the X-ray emission line profiles in O stars can be explained by hot plasma embedded in a cool wind which is highly clumped in the form of radially compressed shell fragments.

Reference: MNRAS, in press, online early
DOI: 10.1111/j.1365-2966.2006.10858.x
Status: Manuscript has been accepted

Weblink: astro-ph/0603286

Comments:

Email: lida@astro.physik.uni-potsdam.de