Opacities for Carbon Dwarfs and M Dwarfs

ALEKSANDRA BORYSOW[1,2] and UFFE GRÅE JØRGENSEN[1]

[1] *Niels Bohr Institute, University Observatory, Copenhagen, Denmark*
[2] *Physics Dept., Michigan Technological University, Houghton MI, U.S.A.*

We have computed new opacity data for collision-induced absorption (CIA) of H_2-H_2 and H_2-He, applicable to oxygen-rich and carbon-rich compositions, and updated existing line data. We have analyzed the combined effect of such data on the model atmospheric structure and the synthetic spectra of dwarfs and giants of various compositions.

The influence of molecular data on the models increases with decreasing effective temperature, and whereas CIA dominates at low metallicities and large gravities, "normal" line transitions dominate at solar metallicity. At $Z = 0.1\,Z_{\odot}$, collision-induced absorption has observable effects on the synthetic spectrum, and for $Z = 10^{-2}$ and lower, CIA absorption is the dominant feature in the infrared spectrum and has major effect on the over-all flux distribution. For low metallicities, the strong depression of the infrared continuum by CIA makes the stars look more metal-deficient than they really are. Spectra of M dwarfs in globular clusters will be totally dominated by CIA absorption, and we predict that their infrared spectra will look very "smooth" – with almost no trace of the usual bands of water and CO – because of the strong CIA continuum depression.

In metal-rich carbon stars the diatomic features (mainly CN and C_2) are much more pronounced in giant stars than in dwarfs, whereas the polyatomics (C_2H_2, C_3, and HCN) show smaller difference between dwarfs and giants. For oxygen-rich stars there is a corresponding balance between the intensities of H_2O, TiO and CIA spectral features, TiO being relatively stronger in the giants, and H_2O being relatively stronger in the dwarfs.

Details of our CIA data and applications to oxygen-rich model atmospheres have been described by Borysow et al. (1997, *A&A*, 324, 185). The support of NATO Collaborative Research Grant CRG.941197 and of the NASA Astrophysics Theory Program is gratefully acknowledged.