Master's thesis – Astronomy and Astrophysics
'Quantitative Near Infra-Red Spectroscopy of Massive Stars'

Abstract:
Interest in near infra-red spectroscopy of massive stars has increased dramatically over the last decades, as it offers the possibility to analyze stars embedded in dusty star forming regions and near the Galactic centre. To this end we investigate the possibility to extend established techniques of spectral analysis to the near infra-red. Using a grid of state-of-the-art FASTWIND non-LTE atmospheres for stars with stellar winds, the behaviour of hydrogen and helium lines is investigated and effective temperature, surface gravity and mass-loss rate diagnostics are identified. Furthermore we present an analysis of both high resolution optical, and, separately, high resolution VLT/CRIRES near-IR spectra in the J, H, K and L-band of nearby dwarf O-type stars. Applying a genetic fitting algorithm approach using FASTWIND, we present a comparison of the stellar and wind properties as derived from these two spectral regimes. In this approach we retrieve the effective temperature to within a sub-type and the surface gravity to within 0.2 dex, but find a discrepancy in the mass-loss rates of 0.2 up to 1.0 dex. We argue that the discrepancy in the mass-loss rates we retrieve, is attributable to a difference in the wind properties of the regimes where the lines are formed, indicating that clumping is of more importance close to the photosphere and is expected to spread and dilute outward with the wind. The He II 1012 nm (4 − 5) transition may prove a valuable diagnostic on such a distance dependent clumping of the stellar outflow.