Quantitative Spectroscopy of IL Lupi, the Optical Component of the High-Mass X-ray Binary 4U 1543-475

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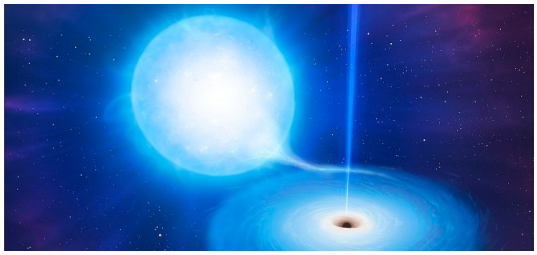
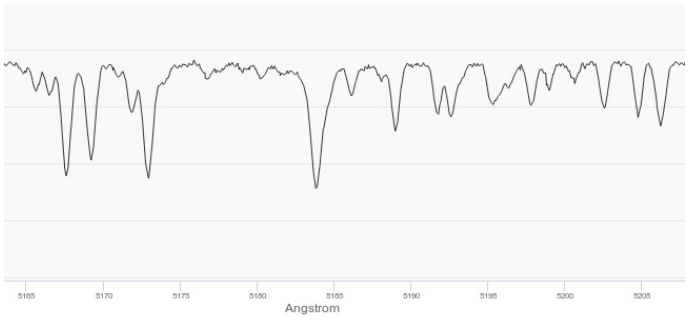
Work focus: Model atmosphere analysis, non-LTE radiative transfer

The High-Mass X-ray Binary (HMXB) 4U 1543-475 at a distance of ∼9 kpc consists of a stellar black hole of ∼9 $M_\odot$ and an optically visible component, the A2 V star IL Lupi. Accretion of mass from the visible star onto the black hole leads to heating of matter in the accretion disk to MK temperatures and to copious emission of X-rays, which lead to the detection of this highly interesting system in the first place.

The star IL Lupi has apparently survived a common envelope phase and the nearby core-collapse supernova that has produced the black hole. Interestingly, no detailed quantitative analysis of the star is reported in the literature so far. Spectra of the optical component were observed with the high-resolution spectrograph UVES on the 8m ESO Very Large Telescope. The Bachelor thesis will concentrate on the determination of chemical abundances using non-LTE and LTE spectrum synthesis techniques and existing analysis tools of the group.

The work offers an insight into the science of massive star binaries, the evolution to HMXBs and state-of-the-art stellar model atmosphere analysis.





Left panel: artistic impression of a HMXB, consisting of a black hole, the surrounding accretion disk, and its donor star. Sometimes a jet is present in such systems, making it observable as a microquasar. Right panel: part of the VLT/UVES spectrum of IL Lupi, in the region of the Mg b triplet. Many metal lines are visible.

Keywords: high-mass X-ray binaries – optical spectroscopy (VLT/UVES) – elemental abundances – stellar atmospheres – non-LTE radiative transfer

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