

Spectropolarimetry of the Massive post-Red Supergiants IRC +10420 and HD 179821

M. Patel^{1,2}, R.D. Oudmaijer¹, J.S. Vink^{3,4}, J.E. Bjorkman⁵, B. Davies^{1,6}, M.A.T. Groenewegen⁷, A.S. Miroshnichenko⁸, J.C. Mottram¹

1 - University of Leeds; 2 - Imperial College London; 3 - Armagh Observatory; 4 - Keele University; 5 - Ritter Observatory; 6 - Rochester Institute of Technology; 7 - Instituut voor Sterrenkunde; 8 - University of North Carolina at Greensboro

We present medium resolution spectropolarimetry and long term photo-polarimetry of two massive post-red supergiants, IRC +10420 and HD 179821. The data provide new information on their circumstellar material as well as their evolution. In IRC +10420, the polarization of the H alpha line is different to that of the continuum, which indicates that the electron-scattering region is not spherically symmetric. The observed long term changes in the polarimetry can be associated with an axi-symmetric structure, along the short axis of the extended reflection nebulosity. Long term photometry reveals that the star increased in temperature until the mid-nineties, after which the photospheric flux in the optical levelled off. As the photometric changes are mostly probed in the red, they do not trace high stellar temperatures sensitively. And so, it is not obvious whether the star has halted its increase in temperature or not. For HD 179821 we find no polarization effects across any absorption or emission lines, but observe very large polarization changes of order 5% over 15 years. During the same period, the optical photometry displayed modest variability at the 0.2 magnitude level. This is unexpected, because large polarization changes are generally accompanied by strong photometric changes. Several explanations for this puzzling fact are discussed. Most of which, involving asymmetries in the circumstellar material, seem to fail as there is no evidence for the presence of hot, dusty material close to the star. A caveat is that the sparsely available near-infrared photometry could have missed periods of strong polarization activity. Alternatively, the variations can be explained by the presence of a non-radially pulsating photosphere. Changes in the photometry hint at an increase in temperature corresponding to a change through two spectral subclasses over the past ten years.

Reference: MNRAS, accepted
Status: Manuscript has been accepted

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Email: m.patel06@imperial.ac.uk