# Observation and modelling of main-sequence star chromospheres – XIX. FIES and FEROS observations of dM1 stars



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| Titre | Observation and modelling of main-sequence star chromospheres – XIX. FIES and FEROS observations of dM1 stars |
| Type de publication | Article de revue |
| Auteur | Houdebine, E.-R. [1], Butler, C.-J. [2], Garcia-Alvarez, D. [3], Telting, J. [4] |
| Editeur | Oxford University Press (OUP) |
| Type | Article scientifique dans une revue à comité de lecture |
| Année | 2012 |
| Langue | Anglais |
| Date | 2012/10/21 |
| Numéro | 2 |
| Pagination | 1591 - 1605 |
| Volume | 426 |
| Titre de la revue | Monthly Notices of the Royal Astronomical Society |
| ISSN | 1365-2966 |
| Mots-clés | stars: chromospheres [5], stars: late-type [6], stars: magnetic field [7], stars: rotation [8] |

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| Résumé en anglais | We present 187 high-resolution spectra for 62 different M1 dwarfs from observations obtained with the FIbre-fed Echelle Spectrograph (FIES) on the Nordic Optical Telescope (NOT) and from observations with the Fibre-fed Extended Range Echelle Spectrograph (FEROS) from the European Southern Observatory (ESO) data base. We also compiled other measurements available in the literature.We observed two stars, Gl 745A and Gl 745B, with no Ca ii line core emission and Hα line equivalent widths (EWs) of only 0.171 and 0.188 Å, respectively. We also observed another very low activity M1 dwarf, Gl 63, with an Hα line EW of only 0.199 Å. These are the lowest activity M dwarfs ever observed and are of particular interest for the non-local thermodynamic equilibrium radiative transfer modelling of M1 dwarfs. Thanks to the high signal-to-noise ratio of most of our spectra, we were able to measure the Ca ii H&K full width at half-maximum (FWHM) for most of our stars. We find good correlations between the FWHM values and the mean Ca ii line EW for dM1 stars. Then the FWHM seems to saturate for dM1e stars. Our previous models of M1 dwarfs can reproduce the FWHM for dM1e stars and the most active dM1 stars, but fail to reproduce the observations of lower activity M1 dwarfs. We believe this is due to an effect of metallicity. We also investigate the dependence of the Hα line FWHM as a function of its EW. We find that the models globally agree with the observations including subwarfs, but tend to produce too narrow profiles for dM1e stars. We re-investigate the correlation between the Ca ii line mean EW and the absolute magnitude. With our new data that notably include several M1 subdwarfs, we find a slightly different and better correlation with a slope of −0.779 instead of −0.909. We also re-investigate the variations of the Hα line EW as a function of radius and find that the EW increases continuously with increasing radius. This confirms our previous finding that the level of magnetic activity in M1 dwarfs increases with the radius. For the first time, we investigate the Wilson–Bappu correlation for a given spectral type. We find a rather linear correlation for stars of absolute magnitude greater than 9.6, but below this value the FWHM seems to saturate. In fact, we show that these Wilson–Bappu type correlations are activity–FWHM correlations and are due to the diminishing column mass of the transition region with decreasing activity level. |
| URL de la notice | http://okina.univ-angers.fr/publications/ua5153 [9] |
| DOI | 10.1111/j.1365-2966.2012.21787.x [10] |
| Lien vers le document | http://dx.doi.org/10.1111/j.1365-2966.2012.21787.x [10] |

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