Stellar Activity Characteristics at FUV and Radio Wavelengths


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Abstract. Since stellar activity can affect atmospheres of close-in habitable exoplanets, knowledge of a star’s activity level is crucial. Different wavelength ranges yield different possibilities on investigating stellar activity phenomena such as flares and coronal mass ejections (CMEs). In this context we present two approaches to this topic using observations from the far-ultraviolet (FUV) and radio domains. The FUV provides density sensitive line ratios, which show enhancements during stellar flaring. The question if these could be correlated to mass expulsions is investigated by analyzing time series of solar UV full-disk measurements using data from the SORCE and TIMED missions. The second approach is dedicated to the decameter wavelength domain, where we use the known correlation between radio decameter type II bursts and CMEs on the Sun. We present the detection of promising events on the active M-dwarf AD Leo which have a high probability of being of stellar origin. These bursts have parameters similar to solar decameter type III bursts which are fast drifting bursts usually correlated with flares on the Sun. Both approaches are discussed and results are presented.

1. Introduction

We are searching for signatures of mass expulsions on the active M star AD Leonis. This dwarf star is known to be a promising target for stellar activity investigations. One of the rare detections of mass motions on stars was found on AD Leo (Houdebine, Foing & Rodono 1990). Since these phenomena are not detectable directly, we use signatures known from the Sun. In the radio data (UTR-2, Kharkov/Ukraine) we search for decameter type II bursts which are
known to be correlated on the Sun to shock waves driven by CMEs. In the FUV (NASA/FUSE) data we search for Doppler-shifted spectral enhancements and enhanced line ratios.

2. Results and Conclusion

In ten nights of decametric observations, where we had only one night of coordinated photometry (Tatranská Lomnica/Slovakia), we found about ten events which show a high probability of being of stellar origin, according to our selection criteria. All of them show a high drift rate of about 0.5-2 MHz/s. These are drift rates known from solar decametric observations of type III bursts. The optical photometry showed a distinct flare on AD Leo but no correlated variation in the radio data.

![Figure 1](image_url)  
Figure 1. Shown are two FUSE spectra of AD Leo. The corresponding light curve of the left spectrum showed a flare, whereas the light curve of the right spectrum didn’t. The enhancement in the blue wing of the OVI line is clearly visible in exposure nr. 38. The spectra were fitted using a multigaussian function.

The analysis of the FUSE data showed beside two flares, which were already presented in Christian et al. (2006), a blue shifted enhancement in the wing of the transition region line OVI (indicated by an arrow in the right panel of Figure 1). This enhancement (nr. 38) occurred one exposure after a flare (37). Although the velocity of this event is about 90 km/s, one can speculate about a projected velocity of a mass expulsion event. Both approaches show that there are more or less unresolved structures on AD Leo which can be related to mass motions.

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References