The relation between magnetic activity and rotation in late-type stars provides fundamental information on stellar dynamos and spin evolution. Previous studies suffer from bias (spectroscopic rotation periods) and inhomogeneity (different instruments/techniques). We characterize the activity/rotation relation of the X-ray emitting main-sequence late-type stars observed by XMM-Newton and Kepler. We measure photometric rotation periods from the high-precision Kepler light curves. As activity indicators, we adopt the X-ray luminosity from XMM-Newton, the number/frequency of white-light and X-ray flares (from the light curves produced in the EXTraS Project [1]).

This is the first analysis of the activity/rotation link across the whole late-type spectral range performed using homogeneous photometric rotation periods from high precision Kepler light curves and homogeneous X-ray flaring activity. Our data reinforce the current picture of the rotation/activity relation and give important insights into the relation between X-ray activity and rotation and between X-ray and white-light flaring activity.

**KEPLER**

High photometric precision optical light curves
High sampling rate (29.4 min)
Large sample of stars (~170,000)
Kepler Input Catalogue: collection of photometry

**SCIENTIFIC RATIONALE**

**ANALYSIS OF THE ACTIVITY/ROTATION RELATION IN LATE-TYPE MAIN-SEQUENCE STARS**

**PHOTOMETRIC ROTATION PERIODS FROM KEPLER**

**MAIN ACTIVITY INDICATORS:**
- X-RAYS FROM 3XMM-DR5 CATALOGUE;
- WHITE-LIGHT AND X-RAY FLARING

**DATA ANALYSIS**

Sample: 107 late-type main-sequence stars detected in 3XMM-DR5 and with light curve in Kepler database
Kepler light curves: brightness modulation due to spots on the rotating stellar surface. Automated algorithm based on Autocorrelation function (ACF) & Lomb-Scargle Periodogram;
Rotation period, Rossby number, white-light flares
X-ray activity: X-ray luminosity from XMM-Newton count rate 0.2-2.0 keV; thermal model kT=0.82 keV (from spectral fit of brightest sources). Search for flares in EXTraS[1] light curves

**RESULTS**

First characterization of the activity/rotation link on the whole late-type main-sequence spectral range with rotation periods measured from high-precision Kepler light curves and homogeneous measure of activity from XMM-Newton data and Kepler light curves.

Rotation periods: 76 stars (72%) present rotational variability -> rotation period in the range ~0.3-70 d. Very high fraction of rotators, due to selection bias towards very active stars. Twenty-nine new rotators.

X-ray activity/rotation:
X-rays flux-limited sample + large average distance of Kepler stars (~270 pc) -> bias towards very active stars (see comparison with the distribution by [3], 90% completeness).
X-ray activity decreases with period: hints of two regimes: correlation for slow rotators, saturation for fast rotators. Good agreement with previous results [4] (K2 sample of M stars within 10 pc), [5], [6].

Flaring activity: white-light flaring rate increases towards later spectral types; possible decrease towards long rotation periods. Six X-ray flares; all with chromospheric long-duration counterpart. Consistent X-ray/white-light flaring rate. Good agreement with [4]

**REFERENCES**

[1] Stelzer et al. 2016 (M stars, K2 sample);
[4] Stelzer B., Damasso M., Scholz S. P. Et al., 2016, August 2016,