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Probing the evolution of stellar activity in open clusters

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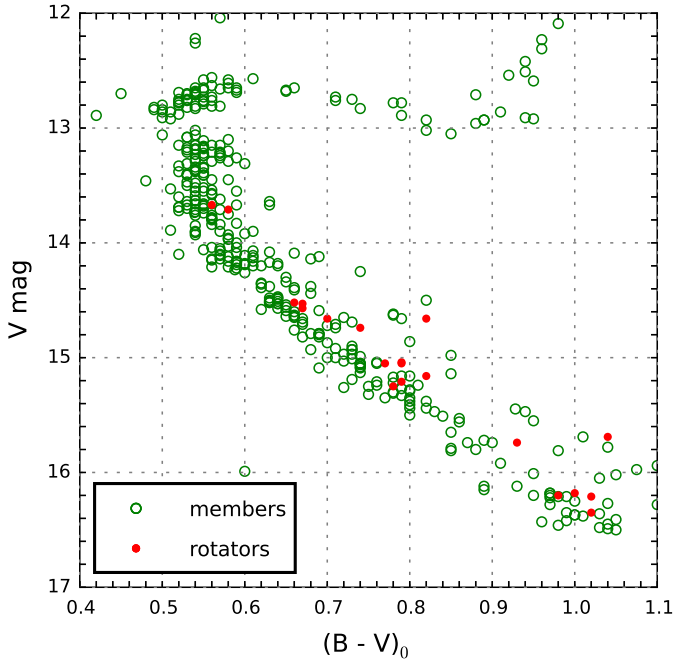
Motivation

Open clusters at different ages are perfect templates for the understanding of stellar evolution. The new method of *gyrochronology* gives us the ability to the derive stellar ages for those clusters with unprecedented precision. The lack of full spectroscopic information on all stars in the region of the cluster can be overcome by using Strömgren photometry and the measurement of the α index ($H\alpha_{narrow}$ - $H\alpha_{wide}$), which serves as an indicator for chromospheric activity. By probing clusters at different ages, the evolution of stellar activity can be investigated.

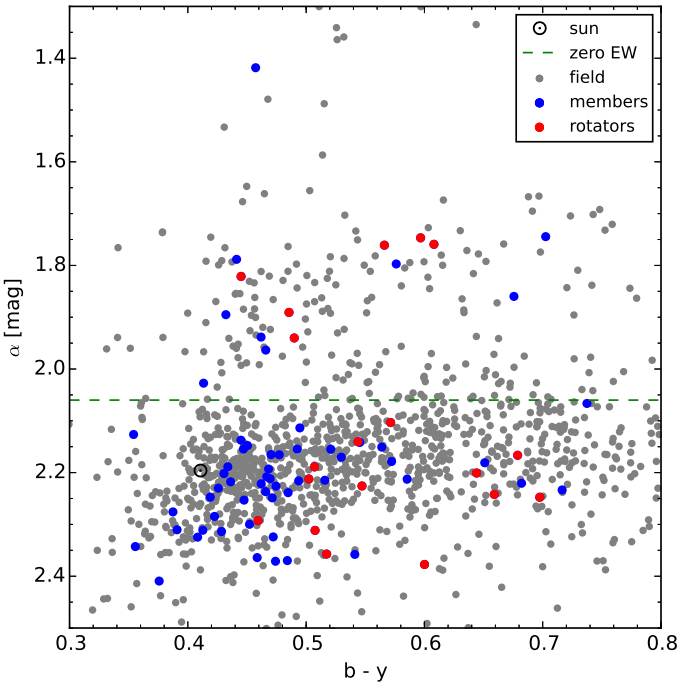
Observation

The galactic open cluster M 67 (= NGC 2682) was observed in campaign 5 of the Kepler K2 mission. By using *gyrochronology* we were able to determine the age of the cluster to about 4.2 $\pm$ 0.7 Gyr (Barnes et al., 2016). Strömgren photometry including the measurement of the α index was achieved using the WiFSIP camera on one of the STELLA telescopes on Tenerife (Strassmeier et al., 2004). Radial velocity membership information was taken from Geller et al. (2015).



This figure shows the color magnitude diagram for M 67. The B-V colour index has been dereddened by 0.029. Radial velocity members are marked as green circles. Members showing rotation signals are shown as dots.

Results



The α index for stars in the region of M 67 as a function of the $b - y$ color index. Field stars are represented by a grey dot, whereas members derived from radial velocity membership are marked as blue dots. Rotators identified in Barnes (2016) are marked in red. The green dashed line marks the index for zero equivalent width in the $H\alpha$ line separating the diagram in chromospherically active stars in the upper region and inactive stars in the lower region. The position of the sun is marked with the respective symbol.

Conclusion

Chromospherically active stars can be found in clusters at solar-like age. This might have a sever impact on the environment of stars hosting an exoplanet and especially their habitability. This activity is obviously not linked to the photospheric signal providing the information about the rotation period of a star. Whereas stars in younger clusters show higher activity like IC 4756, more open clusters with known ages between 500 Myr and 1 Gyr have to be observed. Further clusters at younger ages like M 48 are currently under investigation.

References

Barnes, S. A., ApJ, submitted (2016)
Geller, A., Latham, D. W., & Mathieu, R. D., AJ, 150, 97 (2015)
Strassmeier, K. G. et al. AN 325, 527-532 (2004).