List of publications

Dr. Lisa Bugnet

Top 5 publications are indicated by the ✪ symbol

: 0000-0003-0142-4000
21 Referee articles, among which :
5 first author articles
1 review articles
5 major contributions
10 minor contributions

385 citations (H-index=11)

First Author Articles

Theoretical projects :

5. ✪ Magnetic signatures on mixed-mode frequencies
   II. Gravity-mode period spacings as a probe of internal magnetism.
   Accepted with modifications in Astronomy & Astrophysics

   ***Bugnet, L.** 2022*

   Abstract : I investigate the effect of magnetic fields inside evolved stars with solar-like oscillations on the estimation of the period spacing of gravity-mode components of simulated mixed gravito-acoustic modes. I derive a new corrected stretching function of the power spectrum density to account for the presence of magnetic signatures on their frequencies. I demonstrate that the strong dependency of the amplitude of the magnetic signature with mixed-mode frequencies leads to biased estimates of period spacings towards lower values. A careful analysis of the oscillation frequency pattern through various period spacing estimates on various frequency ranges might lead to the first detection of magnetic fields inside red giants, and, at the same time, to adjust the measured value of the gravity-mode period spacing.

4. ✪ Magnetic signatures on mixed-mode frequencies
   I. An axisymmetric fossil field inside the core of red giants.
   Astronomy and Astrophysics 650 A53
   DOI : 10.1051/0004-6361/202039159
   cited : 6

   ***Bugnet, L.** et al., 2021*

   Abstract : Internal magnetic fields are one amongst the most serious candidates that are currently studied to solve two major problems of stellar astrophysics : 1) The angular momentum transport inside stars of all type and all ages is poorly constrained in our stellar models, resulting in core rotation rate estimates ten times larger than measured rotation rates for red giants. 2) Two population of red giants have been discovered, showing very different power density for their dipolar oscillation mode : intermediate-mass stars tends to have much lower dipolar amplitudes than low-mass stars. Stars more massive than ~ 1.1 $M_{\odot}$ are known to develop a convective core during the main-sequence : the dynamo process due to this convection could be the origin of a strong magnetic field, trapped inside the core of the star for the rest of its evolution. Such magnetic fields should impact mixed modes inside the core of red giants, and their signature should be visible in asteroseismic data. To unravel which constraints can be obtained from these observations, we theoretically investigate the effects of a plausible mixed axisymmetric magnetic field with various amplitudes on the mixed-mode frequencies of red giants. Applying a perturbative method, we estimate the magnetic splitting of the frequencies of simulated mixed dipolar modes that depends on the magnetic field strength and its configuration. The effects of the mass and the metallicity of the stars are explored, and we infer an upper limit for the strength of the field and the associated lower limit for the timescale of its action to redistribute angular momentum in stellar interiors. Finally, we estimate the internal magnetic field amplitude needed along the evolution for its signature on oscillation frequencies to be detectable inside *Kepler*, TESS and PLATO data.

3. ✪ Sounding the internal magnetism of stars using asymptotic magneto-asteroseismology.
   Astronomy and Astrophysics 647 A122
   DOI : 10.1051/0004-6361/202039180
   cited : 5

   Mathis, S., **Bugnet, L.*** et al., 2021*
   **S. Mathis and L. Bugnet equally contributed to this work.*

Abstract : We theoretically study the impact of an axisymmetric stable fossil field on the oscillation frequency of solar-like stars along their evolution. A complete asymptotic analysis is derived, showing the potential of asteroseismology to probe the magnetism at each depth as this has recently been done for stellar rotation ; we show that low-frequency gravity modes coupled with acoustic modes may allow to probe the radial magnetic field component inside the core of red giants through data inversion.

Data analysis projects :

2. ✪ FliPer$_{\rm Class}$: In search of solar-like pulsators among TESS targets
Astronomy and Astrophysics 624 A79
DOI : 10.1051/0004-6361/201834780
cited : 7

***Bugnet, L.** et al., 2019*
: `https://github.com/lbugnet/FLIPER_CLASS`

Abstract : In this paper, we present a classification algorithm built to recognize solar-like pulsators among classical pulsators from TESS data. This machine learning algorithm relies on the global amount of power contained in the power spectral density (PSD), also known as the flicker in spectral power density (FliPer). Because each type of pulsating star has a characteristic background or pulsation pattern, the shape of the PSD at different frequencies can be used to characterize the type of pulsating star. Using noisy TESS-simulated data from the TESS Asteroseismic Science Consortium (TASC), we classify pulsators with a 98% accuracy. Among them, solar-like pulsating stars are recognized with a 99% accuracy, which is of great interest for a further seismic analysis of these stars.

1. ✪ FliPer: A global measure of power density to estimate surface gravities of main-sequence solar-like stars and red giants
Astronomy and Astrophysics 620 A38
DOI : 10.1051/0004-6361/201833106
cited : 23

***Bugnet, L.** et al., 2018*
: `https://github.com/lbugnet/FLIPER`

Abstract : In this work, we present a new metric called FliPer (Flicker in spectral power density, in opposition to the standard Flicker measurement which is computed in the time domain) ; it is able to extend the range for which reliable surface gravities can be obtained ($0.1 < \log g < 4.6$ dex) without performing any seismic analysis for stars brighter than $Kp < 14$. FliPer takes into account the average variability of a star measured in the power density spectrum in a given range of frequencies. Using a large set of asteroseismic targets it is possible to calibrate the behaviour of surface gravity with FliPer through machine learning. This calibration made with a random forest regressor covers a wide range of surface gravities from main-sequence stars to subgiants and red giants, with very small uncertainties from 0.04 to 0.1 dex. FliPer also constrains the surface gravities of main-sequence dwarfs using only long-cadence data for which the Nyquist frequency is too low to measure the acoustic-mode properties.

Review Articles

1. Hidden currents at the Sun's surface
Nature Astronomy 6, pages 631–632
DOI : 10.1038/s41550-022-01683-2
cited : 0

***Bugnet, L.**, 2022*

Abstract : The Sun's surface hosts varying magnetic activities and rotation rates (from equator to pole), and unique solar weather. Now, a combination of ground and space observations has unveiled a previously undetected magnetized plasma current.

Major contributions

5. Detecting deep axisymmetric toroidal magnetic fields in stars
The traditional approximation of rotation for differentially rotating deep spherical shells with a general azimuthal magnetic field
Astronomy & Astrophysics
DOI : 10.1051/0004-6361/202142956
cited : 0

Dhouib, H., Mathis, S., ***Bugnet, L.*** *et al.*

Abstract : We generalise the traditional approximation of rotation (TAR) by simultaneously taking general axisymmetric differential rotation and azimuthal magnetic fields into account. Both the Coriolis acceleration and the Lorentz force are therefore treated in a non-perturbative way. Using this new formalism, we derive the asymptotic properties of MGI waves and their period spacings. We find that toroidal magnetic fields induce a shift in the period spacings of gravity (g) and Rossby (r) modes. An equatorial azimuthal magnetic field with an amplitude of the order of 105 G leads to signatures that are detectable in period spacings for high-radial-order g and r modes in γ Doradus (γ Dor) and slowly pulsating B (SPB) stars. More complex hemispheric configurations are more difficult to observe, particularly when they are localised out of the propagation region of MGI modes, which can be localised in an equatorial belt.

4. TESS Data for Asteroseismology (T'DA) Stellar Variability Classification Pipeline: Set-Up and Application to *Kepler* Q9 data
The Astronomical Journal 162 5
DOI : 10.3847/1538-3881/ac166a
cited : 8

Audenaert, J., [...], ***Bugnet, L.*** *et al., 2021*

Abstract : This is a collaborative effort to gather automatic methods for the automatic classification of oscillating stars observed during the TESS mission. The article describes the different algorithms composing the pipeline, and FliPer parameters are included into a large random forest procedure.

3. ROOSTER: a machine-learning analysis tool for *Kepler* stellar rotation periods
Astronomy and Astrophysics 647 A125
DOI : 10.1051/0004-6361/202039947
cited : 8

Breton, S.N., Santos, A.R.G., ***Bugnet, L.*** *et al., 2021*

Abstract : We adapted the FliPer$_{\rm Class}$ random forest classifier to detect stars that present rotation signals in the asteroseismic data, and to retrieve the correct rotation period from various non-automatic measurements

2. Surface Rotation and Photometric Activity for *Kepler* Targets. I. M and K Main-sequence Stars
The Astrophysical Journal Supplement Series, 244, 1
DOI : 10.3847/1538-4365/ab3b56
cited : 46

Santos, A. R. G., García, R. A., Mathur, S., ***Bugnet, L.*** *et al., 2019*

Abstract : In this work, we analyze the *Kepler* long-cadence data of 26,521 main-sequence stars of spectral types M and K in order to measure their surface rotation and photometric activity level. My contribution is to select reliable rotation estimates by comparing the results from different rotation diagnostics and four data sets with machine learning technics.

1. Revisiting the impact of stellar magnetic activity on the detection of solar-like oscillations by *Kepler*
Frontiers in Astronomy and Space Sciences
DOI : 10.3389/fspas.2019.00046
cited : 19

Mathur, S., García, R.A., ***Bugnet, L.*** *et al., 2019*

Abstract : We study $\sim 1,000$ stars observed by *Kepler* to determine why some solar-type stars do not present detectable modes of oscillations. The strong magnetic activity and/or the chemical composition of some stars could originate this non-detection. My contribution allowed to build the studied non-oscillating solar-type star sample by using the FliPer$_{\rm Class}$ method. This study provides a sample of well characterized stars on which I will base the search for surface magnetism in Axis B of my proposed research.

Minor contributions

10. The K2 Galactic Archaeology Program Data Release 3: Age-abundance Patterns in C1-C8 and C10-C18
The Astrophysical Journal 926 2
DOI : 10.3847/1538-4357/ac2c83
cited : 12

Zinn, J.C. [...], ***Bugnet, L.*** *et al., 2022*

9. Detections of solar-like oscillations in dwarfs and subgiants with Kepler DR25 short-cadence data
Astronomy Astrophysics 657 A31
DOI : 10.1051/0004-6361/202141168
cited : 0

Mathur, S., [...], ***Bugnet, L.*** *et al. 2021*

8. Horizontal shear instabilities in rotating stellar radiation zones
II. Effects of the full Coriolis acceleration
Astronomy and Astrophysics 635 A133
DOI : 10.1051/0004-6361/201936863
cited : 5

Park. J., Prat, V., Mathis, S. & ***Bugnet, L.***

7. The K2 Galactic Archaeology Program Data Release 2: Asteroseismic Results from Campaigns 4, 6, and 7
The Astrophysical Journal Supplement Series 251 23
DOI : 10.3847/1538-4365/abbee3
cited : 14

Zinn, J.C. [...], ***Bugnet, L.*** *et al., 2021*

6. Detection and characterisation of oscillating red giants: first results from the TESS satellite
The Astrophysical Journal Letter, 889 :L34
DOI : 10.3847/2041-8213/ab6443
cited : 25

Silva Aguirre V. [...] ***Bugnet, L.*** *et al., 2020*

5. Age dating of an early Milky Way merger via asteroseismology of the naked-eye star ν Indi
Nature Astronomy, 4, 382-389
DOI : 10.1038/s41550-019-0975-9
cited : 33

Chaplin, W.J. [...] ***Bugnet, L.*** *et al., 2020*

4. A Hot Saturn Orbiting An Oscillating Late Subgiant Discovered by TESS
The Astronomical Journal 157 6
DOI : 10.3847/1538-3881/ab1488
cited : 58

Huber, D. [...] ***Bugnet, L.*** *et al., 2019*

3. A Search for Red Giant Solar-like Oscillations in All *Kepler* Data
Monthly Notices of the Royal Astronomical Society 610
DOI : 10.1093/mnras/stz622
cited : 19

Hon, M. [...] ***Bugnet, L.****, 2019*

2. TESS's first planet. A super-Earth transiting the naked-eye star π Mensae
Astronomy and Astrophysics 619 L10
DOI : 10.1051/0004-6361/201834289
cited :73

Gandolfi, D. [...] ***Bugnet, L****. et al., 2018*

1. HD 89345: a bright oscillating star hosting a transiting warm Saturn-sized planet observed by K2
Monthly Notices of the Royal Astronomical Society 478 4866V
DOI : 10.1093/mnras/sty1390
cited :20

Van Eylen, V. [...] ***Bugnet, L.*** *et al., 2018*

List of oral communications

Dr. Lisa Bugnet

21 Oral communications, among which :
4 invited talks
9 contributed talks
8 invited seminars
8 proceedings
7 posters

Invited Talks

4. Invited review
   2021, KITP program « Probes of Transport in Stars »
3. French Society of Astronomy and Astrophysics, Phd Prize talk, 2021
   2021, Journées de la Société Française d'Astronomie et d'Astrophysique 2021 (Remote contribution because of the Covid-19)
2. Non-seismic surface gravity estimates
   2021, PLATO HOW#2 Workshop (Remote contribution because of the Covid-19)
1. The estimation of stellar masses from non-seismic methods
   2021, PLATO HOW#2 Workshop (Remote contribution because of the Covid-19)

Contributed talks

9. What to expect from non-seismic stellar characterization with PLATO lightcurves
   October 2021, PLATO Science Conference 2021 (Remote contribution because of the Covid-19)
8. In search for intermediate-mass stars' internal magnetic field
   April 2021, OBA stars conference (Remote contribution because of the Covid-19)
7. Probing fossil magnetic effects in the core of evolved low-mass stars using mixed-modes frequencies
   2020, EAS2020 (Remote contribution because of the Covid-19)
6. Probing fossil magnetic effects in the core of evolved low-mass stars using mixed-modes frequencies
   2020, MOBSTER-1 (Remote contribution because of the Covid-19)
5. The impact of fossil magnetic fields on dipolar mixed modes
   2019, Dynamics of the Sun and stars : Honoring the life and work of Michael Thompson, Boulder, CO, USA
4. FliPer$_{\rm Class}$: Towards the classification of all *Kepler* DR25 stars
   2019, Kepler Science Conference IV, Glendale, CA, USA
3. FliPer (Flicker in Power) : A new method to rapidly estimate surface gravities with high precision from main-sequence stars to red giants and red clump stars
   Best contribution prize
   2018, TASC4/KASC11 : First Light in a new era of Astrophysics, Aarhus University, Denmark
2. FliPer : A powerful methodology to rapidly estimate surface gravities and to classify stars
   2018, Annual conference of the French Society of Astronomy and Astrophysics, Bordeaux, France
1. FliPer : A new tool to study global seismic parameters and surface gravity
   2017, Red Giants Workshop, Vienna, Austria

Invited Seminars

8. Astrophysical Fluid Dynamics group seminar, DAMTP
   February 2021, Cambridge University, UK (Remote contribution because of the Covid-19)
7. Exeter Astrophysics Seminar
   October 2020, Exeter University, UK (Remote contribution because of the Covid-19)
6. Lagrange Seminar
   June 2020, Nice Observatory, France (Remote contribution because of the Covid-19)

5. Stellar group seminar
   January 2020, Geneva Observatory, Switzerland (Remote contribution because of the Covid-19)
4. The seminar day on machine learning in astrophysics
   January 2020, CEA Saclay, France
3. Stellar physics seminar at Instituto de Astrofísica de Canarias (IAC).
   2018, Tenerife, Canary Islands, Spain
2. Planetology Group Seminar at Instituto de Astrofísica de Canarias (IAC).
   2018, Tenerife, Canary Islands, Spain
1. Group seminar of the Laboratory Dynamics of Stars, (Exo)-planets and their Environment.
   2018, Astrophysics department, CEA Saclay, France

Proceedings

8. The impact of a fossil magnetic field on dipolar mixed-mode frequencies in sub- and red-giant stars
   2019, Dynamics of the Sun and stars : Honoring the life and work of Michael Thompson, Boulder, CO, USA

   ***Bugnet, L.** et al., 2019*

7. Automatic classification of K2 pulsating stars using machine learning techniques
   SF2A : Proceedings of the Annual meeting of the French Society of Astronomy and Astrophysics

   *Le Saux, A., **Bugnet, L.** et al., 2019*

6. Determining surface rotation periods of solar-like stars observed by the *Kepler* mission using machine learning techniques
   SF2A : Proceedings of the Annual meeting of the French Society of Astronomy and Astrophysics

   *Breton S., **Bugnet, L.** et al., 2019*

5. FliPer: Classifying TESS pulsating stars
   SF2A : Proceedings of the Annual meeting of the French Society of Astronomy and Astrophysics

   ***Bugnet, L.** et al., 2018*

4. Effect of magnetic activity on the detection of acoustic modes in solar-like stars
   The 20th Cambridge Workshop on Cool Stars, Stellar Systems and the Sun

   *Mathur S., García R.A., **Bugnet, L.** et al., 2018*

3. FliPer: Checking the reliability of global seismic parameters from automatic pipelines
   SF2A : Proceedings of the Annual meeting of the French Society of Astronomy and Astrophysics

   ***Bugnet, L.** et al., 2017*

2. Processing of Moon Material in the Protolunar Disk : Devolatilisation During the Protolunar Disk Phase
   Lunar and Planetary Science Conference

   *Charnoz, S., **Bugnet, L.**, Siebert, J., 2016*

1. Moon formation coupled with the protolunar disk
   Division for Planetary Sciences Meeting

   *Charnoz, S., **Bugnet, L.**, Michaut, C., 2015*

Posters

7. Automatic classification of K2 pulsating stars using machine learning techniques
   SF2A : The Annual meeting of the French Society of Astronomy and Astrophysics 2019

   *Le Saux, A., **Bugnet, L.** et al.*

6. Determining surface rotation periods of solar-like stars observed by the *Kepler* mission using machine learning techniques
   SF2A : The Annual meeting of the French Society of Astronomy and Astrophysics 2019

   Breton S., ***Bugnet, L.*** *et al.*

5. Surface rotation and photometric activity for *Kepler* M and K dwarfs
   Kepler & K2 Science conference, Glendale, CA, USA, 2019

   Santos A.R.G., [..], ***Bugnet, L.*** *et al.*

4. FliPer : An automatic method to estimate global parameters of stars.
   The 2019 "Congrès des Doctorants", Institut de Physique du Globe de Paris (IPGP), Paris, 2019

   Bugnet, L. *et al.*

3. Correlation between the non detection of acoustic modes in solar-like stars and their magnetic activity
   TASC5/KASC12 workshop, MIT / Cambridge, USA, 2018

   S. Mathur, R.A. García, ***Bugnet, L.*** *et al.*

2. Correlation between the non detection of acoustic modes in solar-like stars and their magnetic activity
   Cool stars 20, Boston / Cambridge, USA, 2018

   S. Mathur, R.A. García, ***Bugnet, L.*** *et al.*

1. FliPer : Checking the reliability of global seismic parameters from automatic pipelines
   SF2A : The Annual meeting of the French Society of Astronomy and Astrophysics 2017

   Bugnet, L. *et al.*