Thibault BOULET

- SONATA BIS ("CHESS"): grant number 2019/34/E/ST9/00133
- Postdoctoral research (Full-time) at CAMK Warsaw, since April 9, 2025
  - Member of the WST Science Team.
  - Member of the SAGA team

- 2019 - 2025: PhD in Astronomy at the University of Porto
- **Subject:** Galactic Archaeology with red giants in the Milky Way disc

- **Specialties**
  - Supervised machine learning - Asteroseismology - Stellar abundances - Stellar Ages

- **Main latest article**
  - T. Boulet 2024: A catalogue of asteroseismically calibrated ages for APOGEE DR17. The predictions of a CatBoost machine learning model based on the [Mg/Ce] chemical clock and other stellar parameters - Astronomy and Astrophysics, A&A, 685, A66, https://doi.org/10.1051/0004-6361/202348031

- **Activities**
- September – 2025 : **iSpec School** in Wroclaw from the 2nd of September to the 5th of September 2025. Four days of classes on spectroscopy and training with spectroscopic analysis software iSpec.

- January 2026 - **Invited researcher in Torun** to give advice on a Chemical Clock PhD project and to give a seminar on: Supervised machine learning with chemical clocks and stellar parameters for Galactic Archaeology

Contribution to first project

- SNR Analysis for WST MOSHR (High-Resolution Mode)

- **Focus:** Signal-to-Noise Ratio (SNR) trends for Gaia DR3 stars (G = 12–17 mag) in WST MOS High-Resolution (MOSHR) bands

- **Objectives:**
  - Study SNR vs. evolutionary state, metallicity ([M/H] = –2, –1, 0 dex), and band (U, B, V, I)
  - Identify regimes where SNR ≥ 200 (required for high-res science)

- **Key results:**
  - SNR increases systematically from U → I band (×2–3 factor):
    - higher flux + better throughput/QE in red
  - Metallicity trend: higher SNR in blue (U/B) for metal-poor stars (less line blanketing);
    - weaker or reversed in red (I) due to flux redistribution
  - SNR ≥ 200 most reliably reached in V & I bands for $m\_G \lesssim 14$ mag
  - In U/B: only for brightest stars ($m\_G < 13$ mag), better for metal-poor

- **Implications for WST:**
  - Guides target selection & exposure times for MOSHR
  - Highlights need longer exposure time to reach fainter stars (14–17 mag) at high SNR

Galactic
Vanessa Hill, Rodolfo Smiljanic, Eline Tolstoy

The WST will play a transformational role for the study of our Galaxy. Science drivers are developed around the origin of elements, the origin of the Milky Way system, and the origin of stars and planets. The high-resolution MOS will deliver key and precise chemical abundances down to faint stars, while the low-resolution MOS will significantly enlarge the volume up to which information on chemo-dynamics will be accessible. The IFS will allow detailed studies of stellar populations in dense regions of the Galaxy, such as the Bulge or the central parts of star clusters and massive star forming regions.
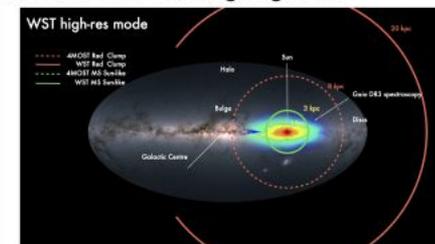

Image credit: Laura Magrini (INAF).

Second project

- **Goals:** **Test Chemical Tagging Viability**
  - Evaluate chemical tagging concept on stars with similar age and birth radius

  - **Obtain Accurate and Precise Stellar Ages**
    - For a restricted sample of dwarfs from the GALAH survey (Buder et al. 2024)
      - $-0.1 <= [Fe/H] <= +0.1$

  - **Analyze Birth Radius**
    - Perform analysis to calculate birth radius of stars (following Minchev et al 2018)

  - **Assess Homogeneity vs. Heterogeneity**
    - Check for chemical homogeneity: Would this invalidate chemical tagging ?
    - Check for chemical heterogeneity: Could tagging work if birth radius is known ?

Sky Coverage
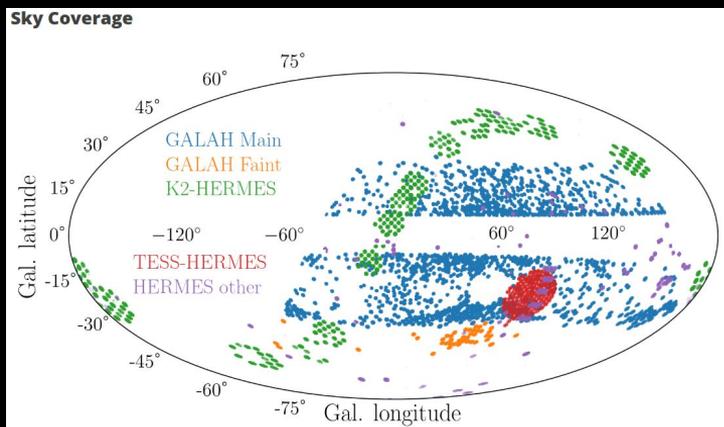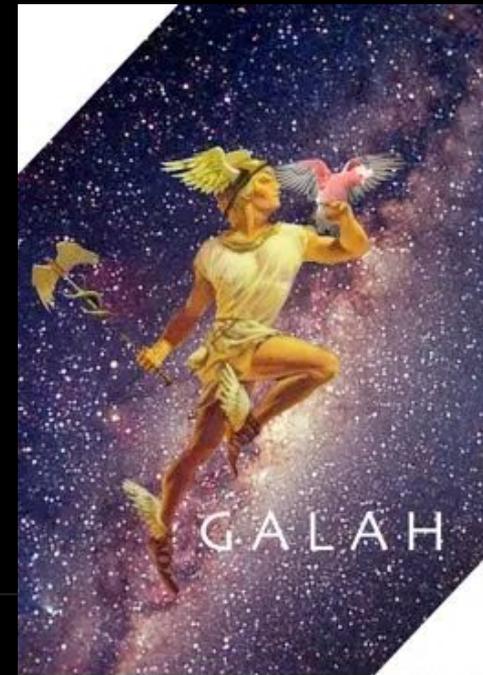
- The overall alpha-element abundance, and up to 30 elemental abundances per star
  - light elements: Li, C, O
  - odd-Z elements: Na, Al, K
  - α-elements: Mg, Si, Ca, Ti (and TiII)
  - iron-peak elements: Sc, V, Cr, Mn, Co, Ni, Cu, Zn
  - light and heavy slow neutron capture elements: Y, Ba, La, Rb, Mo, Ru, Nd, Sm
  - rapid neutron capture element: Eu

3

Contribution to the second project

- Global performance (test set):
  - Mean fractional residual: 8.3%
  - Median fractional residual: 5.7%
  - Strong generalisation capability of the model based on the analysis its learning curves