

## Anke Arentsen



### Title

Exploring the metal-poor inner Milky Way with the Pristine survey

### Abstract

Our Milky Way still hosts remnants from the era of first star formation in the form of (very) metal-poor stars, which we can study in detail. They are useful to learn about the First Stars and the conditions in the early Universe, and they provide unique insights into the early formation and evolution of our Galaxy. Metal-poor stars are typically searched for in the Galactic halo and the dwarf galaxies surrounding the Milky Way. However, a prediction of simulations is that the fraction of metal-poor stars that are very old is highest towards the centers of galaxies: in their bulges.

The task of finding the most metal-poor stars in the inner Milky Way faces many challenges, including large dust extinction, severe crowding and a high average metallicity of the dominant stellar population in the bulge. In this talk, I will present the Pristine Inner Galaxy Survey (PIGS) which has reached unprecedented efficiency in finding metal-poor stars in the bulge region, employing metallicity-sensitive photometry to select candidates for spectroscopic follow-up.

For the first time, using PIGS, we can study the kinematics of thousands of (very) metal-poor inner Galaxy stars, and investigate the occurrence of the chemically peculiar carbon-enhanced metal-poor (CEMP) stars in this region. I will present these results and discuss what they can teach us about the origin of the oldest component of our Galaxy.

# Anke Arentsen

## Curriculum Vitae

11 rue de l'Université, 67000 Strasbourg, France

email: [anke.arentsen@astro.unistra.fr](mailto:anke.arentsen@astro.unistra.fr)

personal website: [link](#)

I am an observational astronomer in the field of Galactic Archaeology

### Education and employment

- 2020 - current    **Postdoc**, Observatoire Astronomique de Strasbourg, CNRS, France
- 2016 - 2020      **PhD** Astrophysics, Leibniz Institute for Astrophysics Potsdam, Germany  
*thesis*: Galactic Archaeology with the oldest stars in the Milky Way, supervisor Dr. Else Starkenburg
- 2014 - 2016      **MSc** Astronomy, University of Groningen, the Netherlands  
*thesis*: determination of stellar atmospheric parameters for the X-shooter Spectral Library, supervisor Prof. Dr. Scott C. Trager
- 2011 - 2014      **BSc** Astronomy, University of Groningen, the Netherlands  
*thesis*: (carbon-enhanced) metal-poor stars in the Milky Way halo and the Sculptor dwarf galaxy, supervisor Prof. Dr. Eline Tolstoy

### Awards

- 2014 - 2016      Netherlands Research School for Astronomy (NOVA) MSc fellowship for talented students

### Publications

- » 4 first-author publications in 2019 and 2020
- » 12 co-authored publications between 2017-2020

See the publication list on the last page for details.

### Accepted telescope proposals and observational experience

Observing proposals: 11 accepted proposals as PI or significantly contributing co-I

- » 40 hours with VLT/UVES (2020A)
- » 33 hours with CFHT/MegaCam (2017A, 2018A, 2019A)
- » 14 nights with AAT/AAOmega+2dF (2017A, 2018A, 2018B, 2019A, 2020A)
- » 17 hours with Gemini/GRACES (2018A)
- » 25 hours with 2.2m/FEROS (2019B)

Observing experience: 12 nights on 2-4m telescopes

- » 9 nights with INT/IDS (2017, 2018)
- » 3 nights with AAT/AAOmega+2dF (2018)

### Teaching experience

- » Teaching assistant 'Einführung in die Astronomie und Astrophysik' (Introduction to Astronomy and Astrophysics) at the HU Berlin (Bachelor course, winter 2017/18)
- » Co-supervision of a master student, Feb. 2020 - Dec. 2020 (AIP/Potsdam University)

## Organisational experience, service and outreach

### Conference organisation

- » SOC chair, EWASS 2019 special session 'Metal-poor stars in Milky Way surveys'
- » SOC co-chair, AG meeting 2019 splinter session 'The early Milky Way as seen through Galactic Archaeology'
- » SOC member, EWASS 2019 special session 'Science calibrations for future European stellar spectroscopic surveys'

### Community service and outreach

- » PhD representative in the AIP Internal Science Committee (Feb. 2019 - July 2020).
- » Program Committee Astronomy member (University of Groningen, 2014-2016).
- » Several public talks on Galactic Archeology at AIP and various schools and science outreach centres in Potsdam and Berlin (2018 - 2019).
- » Various talks on astronomy, science and faith at events organised by student groups and churches (2014 - 2020).
- » Volunteer at the Kapteyn Institute in Groningen for outreach activities (2014 - 2016).

## Conference contributions and seminars

### Selected conference talks from 11 talks at international conferences

- |            |   |
|------------|---|
| July 2018  | Invited talk 'Finding metal-poor stars in the Galactic bulge with Pristine' (The metal-poor Galaxy, Ringberg, Germany)  |
| March 2020 | Contributed talk 'A search for the oldest stars in the inner Galaxy with the Pristine survey' (First Stars VI, Concepción, Chile)   |
| Sept. 2019 | Contributed talk 'Binarity among CEMP-no stars: an indication of multiple formation pathways?' (CEMP Stars as Probes of First-Star Nucleosynthesis, the IMF and Galactic Assembly, Geneva, Switzerland) |
| Dec. 2018  | Contributed talk 'Uncovering very metal-poor stars in the Galactic bulge with the Pristine survey' (Galactic Bulge at the crossroads, Pucón, Chile)   |
| Aug. 2018  | Contributed talk 'Chemistry and binarity in the early Universe: what is the role of metal-poor AGB stars?' (IAU Symposium 343 - Why galaxies care about AGB stars, Vienna, Austria)                     |
| Feb. 2017  | Contributed talk 'Stellar atmospheric parameters for the X-Shooter Spectral Library' (the International Workshop on Stellar Spectral Libraries, Campos do Jordão, Brazil)                               |

### University seminars/talks

- |            |  |
|------------|--|
| Dec. 2020  | University of Groningen, Groningen, the Netherlands (virtual lunch talk) |
| Nov. 2019  | Institute of Astronomy, Cambridge, UK                                    |
| March 2019 | Observatoire de la Côte d'Azur, Nice, France                             |
| Feb. 2019  | Observatoire Astronomique de Strasbourg, Strasbourg, France              |
| Oct. 2018  | University of Victoria, Victoria, Canada                                 |
| June 2018  | Macquarie University, Sydney, Australia                                  |
| June 2018  | University of New South Wales, Sydney, Australia                         |

## Publication list

4 first-author publications (2019-2020)

- » *The Pristine Inner Galaxy Survey (PIGS) II: Uncovering the most metal-poor populations in the inner Milky Way*  
**A. Arentsen**, E. Starckenburg, N. Martin et al. 2020, accepted for publication in MNRAS, arXiv:2006.08641
- » *The Pristine Inner Galaxy Survey (PIGS) I: Tracing the kinematics of metal-poor stars in the Galactic bulge*  
**A. Arentsen**, E. Starckenburg, N. Martin et al. 2020, MNRAS, 491, L11
- » *Stellar atmospheric parameters for the X-Shooter Spectral Library*  
**A. Arentsen**, P. Prugniel, A. Gonneau et al. 2019, A&A, 627, A138
- » *Binarity in CEMP-no stars: an indication of multiple formation pathways?*  
**A. Arentsen**, E. Starckenburg, M. D. Shetrone et al. 2019, A&A, 621, A108

12 co-authored publications (2017-2020)

- » *The X-Shooter Spectral Library (XSL): Data Release 2*  
A. Gonneau, M. Lyubenova et al. (6th author **A. Arentsen**), 2020, A&A
- » *The Pristine survey X: a large population of low-metallicity stars permeates the Galactic disk*  
F. Sestito, N. Martin et al. (4th author **A. Arentsen**), 2020, MNRAS
- » *The Pristine survey - IX. CFHT ESPaDOnS spectroscopic analysis of 115 bright metal-poor candidate stars*  
K. Venn, C. Kieley et al. (7th author **A. Arentsen**), 2020, MNRAS, 492, 3241
- » *The Pristine Survey - VIII. The metallicity distribution function of the Milky Way halo down to the extremely metal-poor regime*  
K. Youakim, E. Starckenburg et al. (7th author **A. Arentsen**), 2020, MNRAS, 492, 4986
- » *The Pristine survey - VII. A cleaner view of the Galactic outer halo using blue horizontal branch stars*  
E. Starckenburg, K. Youakim et al. (6th author **A. Arentsen**), 2019, MNRAS, 490, 5757
- » *The Pristine survey - VI. The first three years of medium-resolution follow-up spectroscopy of Pristine EMP star candidates*  
D. Aguado, K. Youakim et al. (8th author **A. Arentsen**), 2019, MNRAS, 490, 2241
- » *Tracing the formation of the Milky Way through ultra metal-poor stars*  
F. Sestito, N. Longeard et al. (6th author **A. Arentsen**), 2019, MNRAS, 484, 2166
- » *The Pristine survey - V. A bright star sample observed with SOPHIE*  
P. Bonifacio, E. Caffau et al. (17th author **A. Arentsen**), 2019, MNRAS, 487, 3797
- » *The Pristine Dwarf-Galaxy survey - II. In-depth observational study of the faint Milky Way satellite Sagittarius II*  
N. Longeard, N.F. Martin et al. (11th author **A. Arentsen**), 2019, MNRAS, accepted
- » *Pristine Dwarf-Galaxy Survey I: A detailed photometric and spectroscopic study of the very metal-poor Draco II satellite*  
N. Longeard, N.F. Martin et al. (9th author **A. Arentsen**), 2018, MNRAS, 480, 2609
- » *The Pristine Survey IV: Approaching the Galactic metallicity floor with the discovery of an ultra metal-poor star*  
E. Starckenburg, et al. (12th author **A. Arentsen**), 2018, MNRAS, 481, 3838
- » *The Pristine survey I: Mining the Galaxy for the most metal-poor stars*  
E. Starckenburg, N.F. Martin et al. (6th author **A. Arentsen**), 2017, MNRAS, 471, 2587