Sebastiano von Fellenberg

Title

Young Stars in the Galactic Center

Abstract

The Galactic Center harbors a peculiar population of young stars some distributed in a clockwise rotating disk. In this talk I will present the largest spectroscopic survey of the Nuclear Star Cluster using over 600 hours of ESO's SINFONI instrument. The observations were carried out over the last two decades and now cover roughly 25 arc-seconds squared of the Galactic Center. This is a substantial increase in coverage compared to previous works. The analysis of the spectra has led to the spectroscopic classification of over 2800 stars.

We identified around 90 new young stars increasing the total number of known young stars by almost a factor two to ~200. Furthermore, I will show that these young stars are not isotropically distributed, but instead reside in a system consisting of a central warped clockwise disk and several streamers/ streams of young stars at larger radii. Lastly, I will discuss the implications of this result for star formation in the Galactic Center, where I will argue that the young stars formed after the collision and subsequent accretion of two giant molecular clouds about 6 mega years ago.

Sebastiano D. von Fellenberg

Curriculum Vitae

Education

2022 – **Postdoc in Astronomy**, *Max Planck Institute for Radio Astronomy*, Bonn, Germany.

2017 – 2021 **Ph.D. in Astronomy**, Max Planck Institute for Extraterrestrial Physics, Garching bei München, Germany, graded 1.0 (magna cum laude).

- Ph.D. Thesis: "*Probing the physics of the accretion flow of Sgr A**", with Prof. Dr. Reinhard Genzel, Dr. Frank Eisenhauer and Dr. Stefan Gillessen

2016 **Internship**, Laboratoire Univers et Particules de Montpellier, France.
Modelling of stellar atmospheres of massive stars with Fabrice Martins

2015 – 2017 **M.Sc. in Nuclear, Particle, and Astrophysics**, Technische Universtität München, Germany, graded: 1.6.

- M.Sc. Thesis: "*A new far infrared view into the Galactic Center: A detection of Sgr A* in the far infrared*", with Dr. Frank Eisenhauer and Dr. Stefan Gillessen, graded: 1.3.

2014 **M.Sc. in Biophysics**, Universität Leipzig, Germany.

2011 – 2014 **B.Sc. in Physics**, Universität Konstanz, Germany, Graded: 2.0.

- B.Sc. Thesis: "*Determination of Laser Parameter in Material Processing*", with Prof. Dr. Thomas Dekorsy and LPKF, Shanghai, China, graded: 1.1.

2009 – 2011 **Abitur**, Hochrhein Gymnasium Waldshut, Germany, graded 2.0.

2006 – 2009 **Gymnasium**, Deutsche Schule Shanghai, China.

2004 – 2006 **Gymnasium**, Hochrhein Gymnasium Waldshut, Germany.

First Author & Corresponding Author Publications

- **von Fellenberg, S. D.** et al., "Young stars in the Galactic Center", in preparation.
- GRAVITY Collaboration, "Constraining particle acceleration in Sgr A* with simultaneous GRAVITY, Spitzer, NuSTAR and Chandra observations", A&A Volume 654, October 2021, A22.
- **von Fellenberg, S. D.** et al., "A Detection of Sgr A* in the Far Infrared ", ASP Conference Series, Vol. 528, July 2021, p.203
- GRAVITY Collaboration, "The flux distribution of Sgr A*", A&A Volume 638, June 2020, A2.
- **von Fellenberg, S. D.** et al., "A detection of Sgr A* in the far infrared", ApJ Volumen 862, 2018 July, p. 129.

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Co-Author Publications with Major Contributions

- GRAVITY Collaboration, "The mass distribution in the Galactic Centre from interferometric astrometry of multiple stellar orbits", A&A forthcoming article, 2021
- Dallilar Y., **von Fellenberg, S. D.** et al. "Flaremodel: An open-source Python package for one-zone numerical modelling of synchrotron sources ", A&A forthcoming article, 2021
- GRAVITY Collaboration, "Detection of the Schwarzschild precession in the orbit of the star S2 near the Galactic centre massive black hole", A&A Volume 636, April 2020, L5
- GRAVITY Collaboration, "A geometric distance measurement to the Galactic center black hole with 0.3% uncertainty", A&A Volume 625, May 2019, L10

Talks and Conferences

- Invited talk at the New Horizons in Galactic Center Astronomy and Beyond Oct. 21- 24, 2019, Yokohama, Japan
- Solicited talk at the New Horizons in Galactic Center Astronomy and Beyond Oct. 21- 24, 2019, Yokohama, Japan

Observing Experiences

- ***SINFONI:*** **$>$ 30 nights**
- ***NACO:*** **10 nights**

Skills

- **Programming**
  Python, CPL
  Basics: C, Mathematica, bash
- **Data reduction**
  MPE NACO pipeline, spred (SINFONI), GRAVITY DRS, esoreflex
- **Data analysis**
  molecfit

Languages

- **German** Mother tongue
- **English** Fluent
- **French** Basic

Full List of publications

- GRAVITY Collaboration: Deep Images of the Galactic Center with GRAVITY, A&A, forthcoming article 2021
- GRAVITY Collaboration: The GRAVITY young stellar object survey. VII. The inner dusty disks of T Tauri stars, A&A, 655 November 2021, A73

- GRAVITY Collaboration: The mass of Pictoris c from Pictoris b orbital motion, A&A, 654 October 2021, L2
- GRAVITY Collaboration: The GRAVITY young stellar object survey. VI. Mapping the variable inner disk of HD 163296 at sub-au scales, A&A, 654 October 2021, A97
- GRAVITY Collaboration: A geometric distance to the supermassive black Hole of NGC 3783, A&A, October 2021, 654, A85
- GRAVITY Collaboration: GRAVITY K-band spectroscopy of HD 206893 B. Brown dwarf or exoplanet, A&A 652, August 2021, A57
- GRAVITY Collaboration: MOLsphere and pulsations of the Galactic Center's red supergiant GCIRS 7 from VLTI/GRAVITY, A&A 651 July 2021, A37
- GRAVITY Collaboration: Relative depolarization of the black hole photon ring in GRMHD models of Sgr A* and M87* , MNRAS, May 2021, pp.4563-4575
- GRAVITY Collaboration: The central parsec of NGC 3783: a rotating broad emission line region, asymmetric hot dust structure, and compact coronal line region, A&A 648, April 2021, A117
- GRAVITY Collaboration: The GRAVITY young stellar object survey V. The orbit of the T Tauri binary star WW Cha, A&A 648, April 2021, A37
- GRAVITY Collaboration: The central parsec of NGC 3783: a rotating broad emission line region, asymmetric hot dust structure, and compact coronal line region, A&A 648, April 2021, A117
- GRAVITY Collaboration: Improved GRAVITY astrometric accuracy from modeling of optical aberrations, A&A 647, March 2021, A59
- GRAVITY Collaboration: Constraining the Nature of the PDS 70 Protoplanets with VLTI/GRAVITY, AJ 161, March 2021, pp. 22
- GRAVITY Collaboration: Detection of faint stars near Sagittarius A* with GRAVITY, A&A 645, January 2021, A127
- GRAVITY Collaboration: The GRAVITY young stellar object survey IV. The CO overtone emission in 51 Oph at sub-au scales, A&A 645, January 2021, A50
- GRAVITY Collaboration: The ExoGRAVITY project: using single mode interferometry to characterize exoplanets Proceedings Volume 11446, Optical and Infrared Interferometry and Imaging VII; 114460O 2020
- GRAVITY Collaboration: The spatially resolved broad line region of IRAS 09149-6206, A&A, Volume 643, November 2020, A154
- GRAVITY Collaboration: Dynamically important magnetic fields near the event horizon of Sgr A*, A&A 643, November 2020, A56
- GRAVITY Collaboration: Direct confirmation of the radial-velocity planet β Pic c, A&A 642, October 2020, L2
- GRAVITY Collaboration: The GRAVITY young stellar object survey. III. The dusty disk of RY Lup, A&A 642, October 2020 , A162
- GRAVITY Collaboration: A measure of the size of the magnetospheric accretion region in TW Hydrae, Nature 584, 2020, 574-550

- Dexter J. et al.: A parameter survey of Sgr A* radiative models from GRMHD simulations with self-consistent electron heating, MNRAS 494, May 2020, 4168–4186
- GRAVITY Collaboration: Modeling the orbital motion of Sgr A*'s near-infrared flares, A&A 635, March 2020, A143
- GRAVITY Collaboration: Spatially Resolving the Inner Gaseous Disc of the Herbig Star 51 Oph through its CO Ro-vibration Emission, The Messenger 178, December 2019, 40–42
- GRAVITY Collaboration: Probing the Discs of Herbig Ae/Be Stars at Terrestrial Orbits, The Messenger 178, December 2019, 38-40
- GRAVITY Collaboration:Multiple Star Systems in the Orion Nebula, The Messenger 178, December 2019, p.36–38
- GRAVITY Collaboration: Images at the Highest Angular Resolution with GRAVITY: The Case of η Carinae, The Messenger 178, December 2019, 31-33
- GRAVITY Collaboration: Spatially Resolved Accretion-Ejection in Compact Binaries with GRAVITY, The Messenger 178, December 2019, 29-31
- GRAVITY Collaboration: GRAVITY and the Galactic Centre, The Messenger, 178, 26-29
- GRAVITY Collaboration: An Image of the Dust Sublimation Region in the Nucleus of NGC 1068, The Messenger 178, December 2019, 24-26
- GRAVITY Collaboration: Spatially Resolving the Quasar Broad Emission Line Region, The Messenger 178, December 2019, 20-24
- GRAVITY Collaboration: Scalar field effects on the orbit of S2 star, MNRAS 489, August 2019, 4606-4621
- GRAVITY Collaboration: A geometric distance measurement to the Galactic center black hole with 0.3% uncertainty, A&A 625, May 2019 , L10
- GRAVITY Collaboration: Test of the Einstein Equivalence Principle near the Galactic Center Supermassive Black Hole PhRevL 122, March 2019, 101-102
- GRAVITY Collaboration: First direct detection of an exoplanet by optical interferometry. Astrometry and K-band spectroscopy of HR 8799 e, A&A 623, March 2019, L11
- Habibi et al.: Spectroscopic Detection of a Cusp of Late-type Stars around the Central Black Hole in the Milky Way, ApJL 872, February 2019, L15
- Gillessen et al.: Detection of a Drag Force in G2's Orbit: Measuring the Density of the Accretion Flow onto Sgr A* at 1000 Schwarzschild Radii, ApJ 817, January 2019, 126
- GRAVITY Collaboration: Detection of orbital motions near the last stable circular orbit of the massive black hole SgrA*, A&A 618 618, October 2018, L10
- GRAVITY Collaboration: Detection of the gravitational redshift in the orbit of the star S2 near the Galactic centre massive black hole, A&A, July 2018, L15
- Waisberg I. et al.: What stellar orbit is needed to measure the spin of the Galactic centre black hole from astrometric data?, MNRAS 476, February 2018, 3600-3610

- Steinberg E. et al.: Probing the gas density in our Galactic Centre: moving mesh simulations of G2, ApJ 473, September 2017, 1841-1849
- Habibi et al.: Twelve Years of Spectroscopic Monitoring in the Galactic Center: The Closest Look at S-stars near the Black Hole, ApJ 847, September 2017, 120
- Plewa P. et al: The Post-pericenter Evolution of the Galactic Center Source G2, ApJ 840, May 2017, 50
- Gillessen S. et al: An Update on Monitoring Stellar Orbits in the Galactic Center, ApJ 837, March 2017, 19

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