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Young suns and infant planets: probing the origins of solar systems

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List of publications

Refereed publications

26. Sutlieff, B. J., **Bohn, A. J.**, Birkby, J. L., Kenworthy, M. A., Morzinski, K. M., Doelman, D. S., Males, J. R., Snik, F., Close, L. M., Hinz, P. M., & Charbonneau, D. (2021) *High-contrast observations of brown dwarf companion HR 2562 B with the vector Apodizing Phase Plate coronagraph*, MNRAS (in press)
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24. Zhang, Y., Snellen, I. A. G., **Bohn, A. J.**, Mollière, P., Ginski, C., Hoeijmakers, H. J., Kenworthy, M. A., Mamajek, E. E., Meshkat, T., Reggiani, M., & Snik, F. (2021), *The ^{13}CO -rich atmosphere of a young accreting super-Jupiter*, Nature (in press)
23. Vigan, A., Fontanive, C., Meyer, M., Biller, B., Bonavita, M., Feldt, M., Desidera, S., Marleau, G.-D., Emsenhuber, A., Galicher, R., Rice, K., Forgan, D., Mordasini, C., Gratton, R., Le Coroller, H., Maire, A.-L., Cantalloube, F., Chauvin, G., Cheetham, A., Hagelberg, J., Lagrange, A.-M., Langlois, M., Bonnefoy, M., Beuzit, J.-L., Boccaletti, A., D'Orazi, V., Delorme, P., Dominik, C., Henning, T., Janson, M., Lagadec, E., Lazzoni, C., Ligi, R., Menard, F., Mesa, D., Messina, S., Moutou, C., Müller, A., Perrot, C., Samland, M., Schmid, H. M., Schmidt, T., Sissa, E., Turatto, M., Udry, S., Zurlo, A., Abe, L., Antichi, J., Asensio-Torres, R., Baruffolo, A., Baudoz, P., Baudrand, J., Bazzon, A., Blanchard, P., **Bohn, A. J.**, Brown Sevilla, S., Carbillet, M., Carle, M., Cascone, E., Charton, J., Claudi, R., Costille, A., De Caprio, V., Delboulbé, A., Dohlen, K., Engler, N., Fantinel, D., Feautrier, P., Fusco, T., Gigan, P., Girard, J. H., Giro, E., Gisler, D., Gluck, L., Gry, C., Hubin, N., Hugot, E., Jaquet, M., Kasper, M., Le Mignant, D., Llored, M., Madec, F., Magnard, Y., Martinez, P., Maurel, D., Möller-Nilsson, O., Mouillet, D., Moulin, T., Origné, A., Pavlov, A., Perret, D., Petit, C., Pragt, J., Puget, P., Rabou, P., Ramos, J., Rickman, E. L., Rigal, F., Rochat, S., Roelfsema, R., Rousset, G., Roux, A., Salasnich, B., Sauvage, J.-F., Sevin, A., Soenke, C., Stadler, E., Suarez, M., Wahhaj, Z., Weber, L., & Wildi, F. (2021), *The SPHERE infrared survey for exoplanets (SHINE). III. The demographics of young giant exoplanets below 300 au with SPHERE*, A&A (in press), arXiv:2007.06573
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Submitted publications

1. **Bohn, A. J.**, Ginski, C., Kenworthy, M. A., Mamajek, E. E., Meshkat, T., Pecaut, M. J., Reggiani, M., Brown, A. G. A., Cugno, G., Henning, T., Launhardt, R., Quirrenbach, A., Rickman, E. L. & Ségransan, D. (2021), *Unveiling wide-orbit companions to K-type stars in Sco-Cen with Gaia EDR3*, A&A (under review)

Conference proceedings

2. Girard, J. H., Haffert, S. Y., Bae, J., Zeidler, P., de Boer, J., **Bohn, A.**, van Holstein, R. G., Brinchmann, J., Snellen, I., Bacon, R., & Keller, C. (2020), *Planet formation with all flavors of adaptive optics: VLT/MUSE's laser tomography adaptive optics to directly image young accreting exoplanets*, Proc. SPIE, 11448, 1144808
1. Lacour, S., Wang, J. J., Nowak, M., Pueyo, L., Eisenhauer, F., Lagrange, A.-M., Mollière, P., Abuter, R., Amorin, A., Asensio-Torres, R., Bauböck, M., Benisty, M., Berger, J. P., Beust, H., Blunt, S., Boccaletti, A., **Bohn, A.**, Bonnefoy, M., Bonnet, H., Brandner, W., Cantalloube, F., Caselli, P., Charnay, B., Chauvin, G., Choquet, E., Christiaens, V., Clénet, Y., Cridland, A., de Zeeuw, P. T., Dembet, R., Dexter, J., Drescher, A., Duvert, G., Gao, F., Garcia, P., Garcia Lopez, R., Gardner, T., Gendron, E., Genzel, R., Gillessen, S., Girard, J. H., Haubois, X., Heißel, G., Henning, T., Hinkley, S., Hippler, S., Horrobin, M., Houllé, M., Hubert, Z., Jiménez-Rosales, A., Jocou, L., Kammerer, J., Keppler, M., Kervella, P., Kreidberg, L., Lapeyrière, V., Le Bouquin, J.-B., Léna, P., Lutz, D., Maire, A.-L., Mérand, A., Monnier, J. D., Mouillet, D., Muller, A., Nasedkin, E., Ott, T., Otten, G. P. P. L., Paladini, C., Paumard, T., Perraut, K., Perrin, G., Pfuhl, O., Rameau, J., Rodet,

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Curriculum vitae

 was born on August 3, 1993, to Ursula Bohn and Florian Gunzer in the lovely city of Würzburg, located in Lower Franconia, Bavaria. Before I celebrated my first birthday, our family moved to the United States of America, where we lived in Shrewsbury, Massachusetts, in the greater Boston metropolitan region. As my parents were working in academia, we relocated again in 1996. This time we went back to Germany; my parents started working in Hannover, Lower Saxony. This is where I spent most of my childhood.

I can also remember several visits at our grandparents' places in Würzburg. This is probably where I had my first astronomical experiences at the age of approximately six: we used my grandfathers old refracting telescope to observe the moon and to see the rings of Saturn. I was fascinated by what was out there, beyond our Earth. Accordingly, I had to get a poster of our Solar System for my own room.

In 1999 I entered primary school and realized that my interests were quite diverse. I was intrigued by the history of humanity, but first and foremost I enjoyed solving math problems and loved to uncover the laws of physics. Besides attending school, I learned to play the piano, and in my free time I either played soccer, tennis, or I took rowing classes on the local lake.

In 2002, I started taking Latin classes in school. To me this did not feel like learning an actual language; translating ancient texts was more like a puzzle that needed to be solved. As the translation relies on a set of pre-defined rules and symbols, I felt that Latin class was quite similar to math courses. But not only the translation of these ancient manuscript was a lot of fun, also the content directly fed my enthusiasm for history classes: it was fascinating to obtain first-hand insights into Caesar's thoughts during the Gallic War, to learn how to prepare a good speech directly from Cicero, or to discuss moral issues with the Stoic philosopher Seneca the Younger. As this class perfectly combined both these interests of mine, it was not a big surprise to my parents that I also wanted to learn ancient Greek, as soon as this class was offered in school. In the years to come, the books of Virgil, Ovid, and Pliny the Younger were thus supplemented by the works of Aristotle, Plutarch, and Homer. For the sole reason that it was not allowed to graduate with both Latin and ancient Greek as major subjects, I decided to enroll in physics, maths, and Greek for my high-school diploma. These classes were complemented by Latin and history classes as minor subjects.

Due to this broad range of interests, I was uncertain what to do next after my final high-school exams in 2011. By choosing just one possibility, I would exclude so many interesting topics. For that reason I did not start my University studies right away, but participated in a new project that was initiated by the Hannover Medical School (MHH). As a research assistant at the Institute of Cartography and Geoinformatics of Leibniz University Hannover, I obtained hands-on experience with scientific research. I further acquired my first programming skills with Java, which I used to contribute to a project on autonomous real-time analysis of surveillance camera data. Besides these intriguing insights, I had the opportunity to sit in

on various University lectures. Due to these experiences I had made up my mind after one year of scientific research: I decided to study physics, which felt to me as the purest of natural sciences.

For this endeavor I moved to Zurich, Switzerland, where I began my physics studies at ETH Zürich (Swiss Federal Institute of Technology) in 2012. I enjoyed the theoretical approach in the first years: several math classes were mandatory, as this knowledge was crucial to properly describe physical processes. As I did a major in general physics, I did not learn a lot about astronomy during the first two years of my Bachelor. But the introduction class to astrophysics that I took in 2014 directly caught my interest, and I signed up for a field trip as part of the practical coursework. During this trip we stayed on top of the Diavolezza, a mountain in the Swiss Alps with an altitude of almost 3'000 m. At night we went outside to perform simple astronomical observations; during the day we analyzed the data and wrote our report. As I have lived most of my life in big cities, I never had seen such a clear night sky before. The combination with the moonlit panorama of the Eastern Alps was mesmerizing, and intensified my interest in astronomical research.

When I started my Master of Physics in 2015, I therefore signed up for several astronomy courses. I enjoyed a semester project on the detection of exoplanet transits with the University's student telescope and worked on my Master's Thesis entitled "High-contrast imaging of extra-solar planets around the nearest stars". Especially the positive influence of my supervisors Sascha Quanz and Hans Martin Schmid, convinced me to pursue a PhD in astronomy after my undergraduate studies. In August 2017 I started my position at Leiden Observatory, the Netherlands, to continue my work on the direct detection of extra-solar planets under the supervision of Matthew Kenworthy, Frans Snik, and Christoph Keller. The main scientific results that we obtained during this four-year PhD program are collected in this doctoral thesis.

Software



SEVERAL (open-source) software packages were used to create the content of this thesis. The layout and typesetting of the text was performed with $\text{\LaTeX}$ and the cover was designed with Adobe Photoshop and Adobe InDesign. We further used the SIMBAD database, operated at CDS, Strasbourg, France (Wenger et al. 2000). This work has used data from the European Space Agency (ESA) mission Gaia, processed by the Gaia Data Processing and Analysis Consortium (DPAC). Funding for the DPAC has been provided by national institutions, in particular the institutions participating in the Gaia Multilateral Agreement. This thesis makes use of VOSA, developed under the Spanish Virtual Observatory project supported by the Spanish MINECO through grant AyA2017-84089. To achieve the scientific results presented in this thesis we made use of the *Python* programming language,⁷ especially the *SciPy* (Virtanen et al. 2020), *NumPy* (Oliphant 2006), *Matplotlib* (Hunter 2007), *emcee* (Foreman-Mackey et al. 2013), *scikit-image* (Van der Walt et al. 2014), *scikit-learn* (Pedregosa et al. 2012), *photutils* (Bradley et al. 2016), and *astropy* (Astropy Collaboration et al. 2013, 2018) packages.

⁷Python Software Foundation, <https://www.python.org/>

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⁸Dazu empfehle ich euch insbesondere Kapitel 1.1.