

## Vito Squicciarini



### Title

Can a massive star possess its own planetary system?

### Abstract

Most exoplanet surveys have so far focused on stars not larger than the Sun, and about 90% of the 4500 known exoplanets lie closer to their stars than the Earth is to the Sun. This strong observational bias has recently started being complemented by direct imaging, a technique that -contrary to transits and radial velocities- is preferentially sensitive to young giant planets in wide orbits. Although giant planets have been shown to be increasingly common around more massive star, the occurrence frequency, according to radial velocity studies, has a turnover at about  $2 M_{\text{sun}}$  and goes down to zero at  $M > 3 M_{\text{sun}}$ . This is in line with theoretical expectations from the core accretion model: due to a more rapid dispersal of the protoplanetary disk around heavier stars, giant planets around intermediate and massive stars should simply not exist. To clarify if this shortage is real or if it is rather the result of an observational bias, we initiated the direct-imaging B-star Exoplanet Abundance Study (BEAST), the first survey explicitly targeting 85 young B stars ( $M > 2.4 M_{\text{sun}}$ ) to look for exoplanets around them. While the survey is still in progress, its provisional results -that I will show here- are already intriguing, challenging everything we used to know about giant planet formation under exotic environments.

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## EMPLOYMENT HISTORY

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### Current Position

2019 - Present    PhD Student    Università degli Studi di Padova

## EDUCATION

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2017-2019    Master in Astronomy    University of Padova, Italy

2013-2017    Bachelor in Physics    University of Padova, Italy

## RESEARCH

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My career so far has been focused on two main paths:

1. studying the occurrence for giant planets around intermediate and massive stars to have insights on their formation mechanisms;
2. assessing the possibility of biotic oxygen build-up in the atmospheres of habitable Earth-like planets.

To achieve these goals I have:

- (a) contributed to data reduction and analysis of the ongoing direct-imaging BEAST survey;
- (b) improved kinematic techniques to indirectly estimate stellar ages of B stars for a better mass determination of directly-imaged exoplanets and brown dwarfs;
- (c) developed a tool bridging stellar evolution models with large catalogues to rapidly turn automatically collected photometric data of stellar samples into mass and age estimates;
- (d) created a model that incorporates experimental evidence of photosynthetic bacteria thriving under the irradiation of M stars within the framework of models of the Earth's oxygenation history.

### Main Research Projects

#### *SpHere INfrared survey for Exoplanets (SHINE)*

Guaranteed time direct-imaging search for exoplanets using the Spectro-Polarimetric High-contrast Exoplanet REsearch ([SPHERE](#)) planet-finder camera at VLT

*Contributions: derivation of masses for the new binary systems discovered in Bonavita et al. (2021).*

#### B-star Exoplanet Abundance Study (BEAST)

Large program searching for exoplanets through the SPHERE planet-finder camera at VLT

*Contributions: data reduction and analysis; confirmation and characterization of candidate companions; age and mass determinations for the stellar host and the confirmed companions; interpretation of the results in the light of the existing models.*

#### Atmospheres in a test tube

Experiment studying the possibility for oxygenic photosynthesis to occur on habitable planets around M stars

*Contributions: development of a toy model assessing the possibility of biotic oxygen buildup for a Earth-like planet orbiting a less massive star than the Sun.*

## LATEST SEMINARS AND TALKS

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2021	contributed talk	ESO Workshop: The Star-Planet Connection	virtual event
2021	contributed talk	From Clouds to Discs: A Tribute to the Career of Lee Hartmann	Dublin, Ireland*
2021	contributed talk	Star Clusters: the Gaia Revolution	Barcelona, Spain*
2021	contributed talk	EPSC 2021 – Europlanet Science Congress 2021	virtual event
2021	contributed talk	AbGradCon 2021 – Astrobiology Graduate Conference	virtual event
2021	invited talk	Journal Club - The Royal Observatory, Edinburgh	Edinburgh, UK*
2021	contributed talk	NASA 2021 Sagan Exoplanet Summer Virtual Workshop	Pasadena, US*
2021	contributed talk	ISM 2021 – Structure, characteristic scales, and star formation	Beirut, Lebanon*
2021	contributed talk	XVI Congresso Nazionale di Scienze Planetarie	Padova, Italy

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\* held virtually

## TRAINING AND CAREER DEVELOPMENT

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2021	workshop	ENGAGE 2021 – Comunicazione e divulgazione della scienza	Venice, Italy
2021	program	The Physics of the Emergence of Life	Garching, Germany
2021	PhD School	RED'21 School – Astrobiology Introductory Course	Le Teich, France*
2021	PhD School	10th VLTI School of Interferometry	Sophia-Antipolis, France*
2021	PhD School	Summer School in Statistics for Astronomers XVI	State College, USA*
2021	symposium	IX ELSI International Symposium - Science in Society	Tokyo, Japan*
2020	course	Python Course 2020	Padova*, Italy
2020	workshop	ENGAGE 2020 – Comunicazione e divulgazione della scienza	Pisa*, Italy

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\* held virtually

## OUTREACH

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2021	panelist	Notte europea dei ricercatori 2021	Padova, Italy
2021	contributed video	Percorsi Galileiani – PhD edition	Padova, Italy

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## PUBLICATION RECORD

### Publications Currently Under Review

2021 Squicciarini, V. et al. *A scaled-up Solar System around a massive star*, submitted to SCIENCE

2021 Janson, M. et al, including Squicciarini V., *A wide-orbit giant planet in a high-mass binary system*, accepted in NATURE

### Complete Publication List

2021 Squicciarini V., Gratton R., Bonavita M., et al., *Unveiling the star formation history of the Upper Scorpius association through its kinematics*, [MNRAS,507,1381](#)

2021 Mesa D., Marino S., Bonavita M., et al., including Squicciarini V., *Limits on the presence of planets in systems with debris discs: HD 92945 and HD 107146*, [MNRAS,503,1276](#)

2021 Bonavita M., Gratton R., Desidera S., et al., including Squicciarini V., *New binaries from the SHINE survey*, [arXiv,arXiv:2103.13706](#)

2021 Janson M., Squicciarini V., Delorme P., et al., *BEAST begins: sample characteristics and survey performance of the B-star Exoplanet Abundance Study*, [A&A,646,A164](#)

2021 Claudi R., Alei E., Battistuzzi M., et al., including Squicciarini V., *Super-Earths, M Dwarfs, and Photosynthetic Organisms: Habitability in the Lab*, [arXiv,arXiv:2101.04448](#)

2021 Carleo I., Desidera S., Nardiello D., et al., including Squicciarini V., *The GAPS Programme at TNG. XXVIII. A pair of hot-Neptunes orbiting the young star TOI-942*, [A&A,645,A71](#)