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Early-results from SHINE, the SPHERE High-Contrast Imaging Survey for Exoplanets

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Abstract

With the development of high contrast imaging techniques and instruments, vast efforts have been devoted during the past decades to detect and characterize lighter, cooler and closer companions to nearby stars, and ultimately image new planetary systems. Complementary to other planet-hunting techniques, this approach has opened a new astrophysical window to study the physical properties and the formation mechanisms of brown dwarfs and planets. With the SPHERE XAO instrument first Light at VLT in May 2014, we have initiated with SHINE, the Sphere High-contrast-ImagiNg survey for Exoplanets, a systematic characterization of 400-600 young, nearby stars close environment aimed at hunting and studying the physical and statistical properties of the giant planet population at wide orbits (>5 AU) between 2015 and 2020. In this talk, we will briefly present the main properties of the SHINE sample, the observing and data reduction and analysis strategy, the current detection performances achieved with the combination of both near-infrared instruments IRDIS and IFS, finally the key early-results obtained so far with the characterization of giant planets, the study of planetary system architectures, finally the first exploitation of the statistical information after 2.5 years of operation.

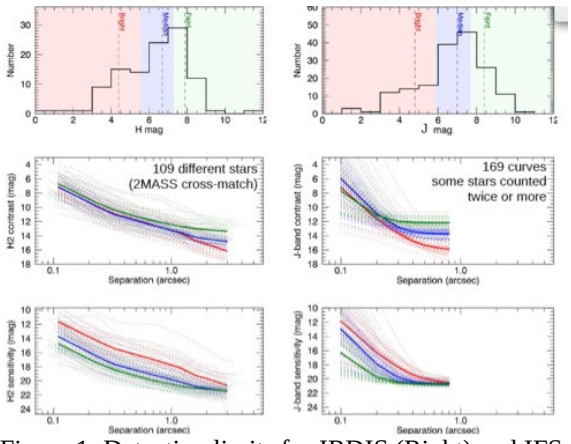

Figure 1: Detection limits for IRDIS (Right) and IFS (Left) for the SHINE sample (medium conditions)

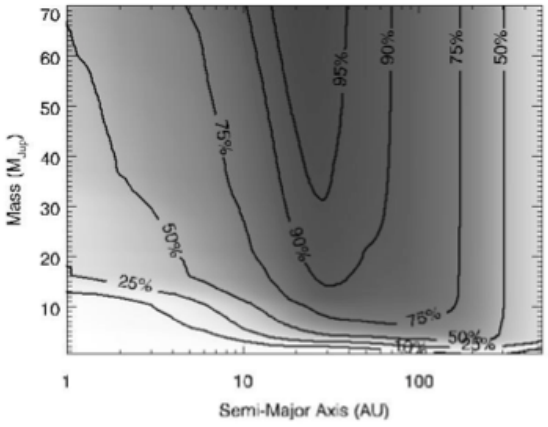

Figure 2: QMESS (Bonavita, 2013) average detection probability for SHINE using observed targets

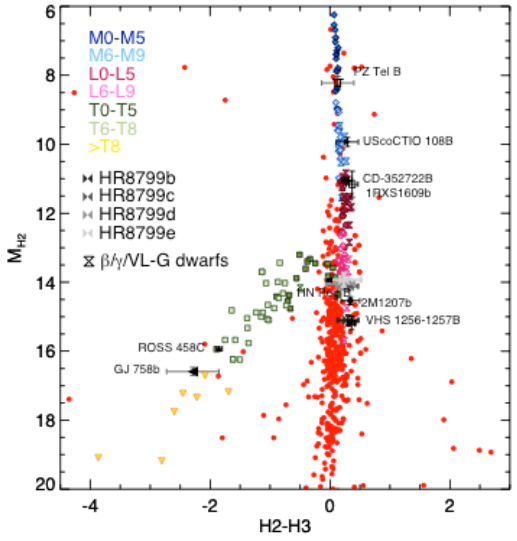

Figure 3: Color-magnitude diagramm including all SHINE candidates and example of known systems.

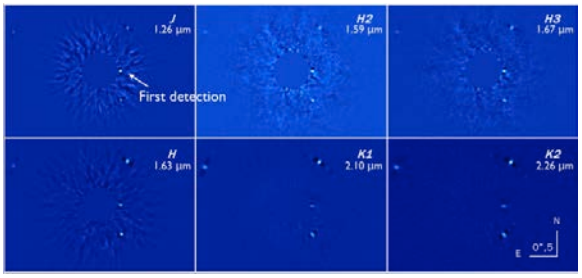

Figure 4: Illustration of the SHINE capability for the famous HR8799 exoplanetary system (Zurlo 2015, Bonnefoy 2015).

Conclusions

The SHINE program is a large high-contrast near-infrared survey of 600 young, nearby stars. Aiming at searching for and characterizing new planetary systems using VLT/SPHERE, it achieves unprecedented high-contrast and high-angular resolution imaging capabilities which bring new statistical constraints on the occurrence and orbital properties of the giant planet population at large orbits as a function of the stellar host mass and age.

Acknowledgements

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References

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[3] Zurlo, A., et al. 2015, A&A, 587, 57