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Notice for the PhD Viva Voce Examination

Ms Belinda Damian (Registration Number: 2071206), PhD scholar at the School of Sciences, CHRIST (Deemed to be University), Bangalore will defend her PhD thesis at the public viva-voce examination on Tuesday, 2 July 2024 at 11.00 am in Room No. 044, Ground Floor, R & D Block, CHRIST (Deemed to be University), Bengaluru - 560029.

Title of the Thesis	:	**Study of Low-Mass Stars and Brown Dwarfs In Star Forming Regions of Diverse Environments**
Discipline	:	**Physics**
External Examiner (Outside Karnataka)	:	**Dr Saurabh Sharma** Scientist F Aryabhatta Research Institute of Observational Sciences (ARIES) Manora Peak, Nainital Uttarakhand- 263001
External Examiner (Within Karnataka)	:	**Dr Devendra Kumar Sahu** Professor Indian Institute of Astrophysics II Block, Koramangala Bengaluru - 560034 Karnataka
Supervisor	:	**Dr Sreeja S Kartha** Assistant Professor Department of Physics and Electronics School of Sciences CHRIST (Deemed to be University) Bengaluru - 560029 Karnataka
Co-Supervisor	:	**Dr Jessy Jose** Associate Professor Department of Physics IISER Tirupati Tirupati - 517507 Andhra Pradesh

The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva-voce examination.

Registrar

Place: Bengaluru
Date: 25 June 2024

ABSTRACT

The formation and evolution of low-mass stars and brown dwarfs is an intricate process orchestrated by the environmental conditions in which they form. Circumstellar disks, a natural byproduct of this process, play a pivotal role in determining the fate of the star and the timescale for planet formation. While low-mass stars are a dominant product of the star formation process, brown dwarfs occupy a unique position, bridging the gap between low-mass stars and planets. Identifying and exploring these cool objects aid in understanding their dominant formation mechanism and in tracing the very low-mass end of the initial mass function (IMF). In this thesis, we study these substellar objects in diverse environments ranging from nearby low-mass clusters to distant feedback driven massive regions using deep multi-wavelength photometry as well as near-IR spectroscopy with 4 m and 10 m class telescopes. This includes the usage of a novel water-band photometry technique that discerns ultra-cool dwarfs that contain water in their atmosphere and the comparison of wide wavelength range SEDs with atmospheric models. We use Gaia astrometry and photometry to verify the nature of these objects and characterise them using follow-up low-resolution spectroscopy.

With masses ranging from high-mass stars to the Jupiter-mass sources, we probe the IMF down to the planetary mass regime and find that on par with other young star forming regions, the form of the IMF does not show dependence on the environmental conditions. We also analyse the properties of the disks around the young stellar objects by testing their occurrence and distribution relative to the ionising sources in the vicinity and their dependence on the host star properties. Our results substantiate the effect of feedback from massive stars on the evolution of disks and the extent of this influence is characterised by the strength of the UV radiation fields. Conclusively, this thesis dissects the birth of low-mass stars and brown dwarfs within young clusters in diverse environments. This facilitates understanding the disk evolution in response to the effects of the environment, provides clues to the formation of brown dwarfs, and helps model planet formations around low-mass objects.

Keywords: Brown dwarfs -- Low-mass stars -- Protoplanetary disks -- Initial mass function -- Star forming regions -- Young stellar objects

Publications:

1. **Damian, B.,** et al., "A Novel Survey for Young Substellar Objects with the W-band Filter. VI. Spectroscopic Census of Substellar Members and the IMF of the σ Orionis Cluster", *The Astrophysical Journal*, vol. 951, no. 2, 2023. doi:10.3847/1538-4357/acd115.
2. **Damian, B.,** et al., "Protoplanetary disks around young stellar and substellar objects in the σ Orionis cluster", *Journal of Astrophysics and Astronomy*, vol. 44, no. 2, 2023. doi:10.1007/s12036-023-09968-2