Inter-University Centre for Astronomy and Astrophysics
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December 11, 2024

Search Committee
Department of Physics and Astronomy
University of Missouri
Columbia, MO, USA

Dear Members of the Search Committee,

I am writing to express my interest in the postdoctoral researcher position in astronomy and astrophysics at the University of Missouri. My research bridges galactic astrophysics with cosmology and dark matter physics, utilizing full hydrodynamic cosmological simulations such as IllustrisTNG, EAGLE, and CAMELS to study the impact of galactic astrophysical processes on dark matter haloes. In parallel, I develop controlled numerical experiments to investigate galaxy formation and its interplay with dark matter haloes in simplified environments. These complementary approaches have equipped me with the expertise and independence to design and lead innovative research projects. **I have a clearly formulated research plan to build a physical description of the response of dark matter haloes to galactic astrophysical processes, aiming to significantly enhance our ability to infer cosmology and dark matter physics from observations.**

Currently, I am a Senior Research Scholar at IUCAA, where I have submitted my PhD thesis under the supervision of Prof. Aseem Paranjape. My thesis focuses on the astrophysical effects of galaxy formation on dark matter haloes, emphasizing changes in radial density profiles, which are crucial to understanding observables such as rotation curves. While my primary focus has been analyzing large-scale cosmological simulations, I also develop semi-numerical experiments to study specific aspects of galaxy-halo interactions in a controlled setting. My technical expertise spans running cosmological hydrodynamic simulations using tools such as GADGET, AREPO, and MUSIC, as well as analyzing halos, galaxies, and the large-scale structure with ROCKSTAR and VELOCIraptor. Additionally, I have conducted cosmological inference from surveys like eBOSS and mock DESI data using advanced statistical and machine learning methods.

Looking forward, I am particularly eager to apply my expertise in galaxy evolution and machine learning to explore the evolution of dark matter haloes and their baryonic components. My work aligns well with the University of Missouri's focus on galaxy evolution, and I am excited by the prospect of contributing to Prof. Charles Steinhardt's research group. The university's emphasis on fostering diversity and promoting intellectual pluralism resonates strongly with my commitment to creating inclusive and supportive academic environments through mentoring and outreach.

Thank you for considering my application. I have included my CV, research statement, and publication list. I look forward to the opportunity to discuss how my research can contribute to the

vibrant astrophysics community at the University of Missouri.

Sincerely,
Premvijay Velmani,
Senior Research Scholar,
IUCAA Pune, India