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

Prof. Charles Steinhardt
Department of Physics and Astronomy
University of Missouri
Columbia, MO, USA

Dear Prof. Steinhardt,

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 galaxy evolution and its interplay with dark matter haloes. In parallel, I develop controlled numerical experiments to investigate galaxy formation and feedback processes in simplified environments. These complementary approaches have equipped me with the expertise to build physical model from simulations that are directly connected to observations. I am eager to strengthen this connection by contributing to your group's work on galaxy properties and evolution using observational data.

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 and their implications for observables such as rotation curves. While my primary focus has been analyzing large-scale cosmological simulations, I have also conducted cosmological inference from survey data (e.g., eBOSS and mock DESI) and have experience applying advanced statistical and machine learning techniques. I am particularly interested in utilizing these tools to analyze observations of galaxy evolution, such as star formation and its connection to feedback processes, which are central to your research program.

Looking forward, I aim to further explore the connection between simulations and observations to understand the co-evolution of galaxies and their dark matter haloes. I also have a clearly formulated research plan to build a physical description of the response of dark matter haloes to baryonic processes, with direct applications to integrating galactic observations to cosmological surveys. This effort complements my interest in leveraging simulations to study star formation and feedback processes, and I am excited to develop this expertise in your group while contributing to ongoing projects.

The collaborative environment at the University of Missouri and the opportunity to work closely with you on galaxy evolution research strongly align with my goals. I am particularly inspired by the department's emphasis on fostering diversity and promoting intellectual pluralism, which resonates with my own commitment to mentoring and creating inclusive academic environments.

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 skills and research interests align

with your group's goals and the broader astrophysics program at Missouri.

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