Physics Colloquium

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Uncovering Energetic Processes in the Interstellar/Intergalactic Medium with the Square Kilometre Array

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Abstract

Investigating the physics and energetic of the medium where galactic structures, on various scales, are formed is the most fundamental step to understand the formation and evolution of galaxies. Modern galaxy evolution models suggest gas accretion from the intergalactic medium (IGM) or from cosmic filaments as a mechanism to maintain star formation and active galactic nucleus (AGN). Through gas heating and/or gas removal, these models also propose supernova feedback and AGN feedback as mechanisms to quench massive star formation. Observational studies, however, have not reached to a conclusive result showing that feedback can, in some cases, trigger star formation, leaving the issue as an open challenge. It seems that some basic concepts about the formation of structures in the interstellar medium (ISM) and the IGM are missed: What are physical parameters/agents governing the structure formation on various scales? How does the ISM/IGM energy balance change over cosmic time? The advent of the square kilometre array (SKA) and its instrumental capabilities tracing the most energetic ISM components has opened a new window shedding light on the issue. The SKA's sensitive radio continuum observations will trace high-energy particles and magnetic fields not only in star forming regions and AGNs, but also in more quiescent regions in molecular clouds and diffuse IGM, enabling us to study the role of magnetic fields/cosmic rays in structure formation. Sensitive radio continuum observations on large scales may also bring constrains on the entity of dark matter mapped by the Hubble Space Telescope (HST) and Dark Energy Camera (DECam).

Link
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