Probing deeper into origins of cosmic rays
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Cosmic rays are high-energy atomic particles continually bombarding Earth's surface at nearly the speed of light. Our planet's magnetic field shields the surface from most of the radiation generated by these particles. Still, cosmic rays can cause electronic malfunctions and are the leading concern in planning for space missions.

Researchers know cosmic rays originate from the multitude of stars in the Milky Way, including our sun, and other galaxies. The difficulty is tracing the particles to specific sources, because the turbulence of interstellar gas, plasma, and dust causes them to scatter and rescatter in different directions.

In their first experiment, they simulated cosmic rays moving through interstellar space and interacting with localized magnetized clouds, represented as tubes. The rays travel undisturbed over a long period of time. They are interrupted by chaotic interaction with the magnetized clouds, resulting in some rays reemitting in random directions and others remaining trapped.

Monte Carlo numerical analysis, based on repeated random sampling, revealed ranges of density and reemission strengths of the interstellar magnetic clouds, leading to skewed, or heavy-tailed, distributions of the propagating cosmic rays.

The analysis denotes marked superdiffusive behavior. The model's predictions agree well with known transport properties in complex interstellar media.

"Our model provides valuable insights on the nature of complex environments crossed by cosmic rays and could help advance current detection techniques," author Salvatore Buonocore said.

More information: Salvatore Buonocorea) and Mihir Sen. Anomalous diffusion of cosmic rays: A geometric approach featured. AIP Advances