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Abstract for an Invited Paper
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One Hundred Years of Cosmic Rays: Going to Extremes¹

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In 1912, a balloon experiment by V. Hess demonstrated that the ionization of the Earth's atmosphere is due in part to an extraterrestrial source. In the hundred years since, we have recognized that these "cosmic rays" are charged particles, that they are responsible for some of the most energetic emissions in the Universe, and that collectively they account for about 1/3 of the energy density in the interstellar medium, although they represent a minuscule fraction of interstellar particles. After reviewing the observations, I will discuss current theories of how cosmic rays are accelerated, how they propagate in galactic and intergalactic space, and how they couple dynamically to the ambient medium, despite being virtually collisionless. These processes share some common features with energetic particles in laboratory plasmas, and I will touch upon links to lab experiments as well.

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