

# Interstellar cosmic-ray spectra (1) just outside the heliosphere and (2) in the local medium: are they the same?

---

**Elena Orlando**

*Department of Physics, University of Trieste and National Institute of Nuclear Physics  
via Valerio 2, 34127 Trieste, Italy*

*Kavli Institute for Particle Astrophysics and Cosmology and Hansen Experimental Physics Laboratory,  
Stanford University*

*Lomita Mall 452, Stanford, CA, U.S.A.*

*E-mail: [orlandele@gmail.com](mailto:orlandele@gmail.com)*

Interstellar cosmic ray (CR) spectra just outside the heliosphere are accessible thanks to direct measurements of CR, with uncertainties given by the solar modulation. Interstellar CR spectra in the local medium (i.e. within  $\sim 1$  kpc around the Sun) are indirectly accessible thanks to observations of interstellar emissions in radio/microwaves and in gamma rays produced by CR interactions with the interstellar medium and the Galactic magnetic field. Observations of these interstellar emissions are an invaluable tool for understanding densities and spectra of CR in different places of our Galaxy. The derivation of both spectra depends on model assumptions. Until very recently it was believed that CR as directly measured were resembling CR throughout the Galaxy, after accounting for solar modulation and propagation effects. However, present precise data and sophisticated modeling are posing significant challenges. If interstellar CR spectra just outside the heliosphere and in the local medium are the same is a question that has recently opened again. We present here our effort in answering this question and our recent results.

*37th International Cosmic Ray Conference (ICRC 2021)*

*July 12th – 23rd, 2021*

*Online – Berlin, Germany*

## 1. Introduction