Contribution ID: **14** Type: **Invited highlight talk**

Cosmic-ray ionization in diffuse clouds

Friday 8 June 2018 14:00 (30 minutes)

Cosmic rays are believed to play an essential role in determining the chemistry and the evolution of molecular clouds. This is because they are usually considered to be the main ionization agent of these star-forming regions. In this talk, we will examine such hypothesis from a theoretical point of view for the case of diffuse clouds. This will be achieved by studying the cosmic-ray spectra in the cloud's interior using the one-dimensional cosmic-ray transport equation. Interestingly, it is found that energy losses effectively reduce the cosmic ray flux in the cloud interior for low energy cosmic rays in such a way that the predicted ionization rate is more than 10 times smaller than the one inferred from the observational data. A brief discussion on the implication of this finding in terms of spatial fluctuation of the Galactic cosmic ray spectra and possible additional sources of low energy cosmic rays will be given in the end.

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Session Classification: Highlight talks