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This scene-setting talk will focus on theoretical aspects of particle acceleration at shocks as they move from near the Sun to 1 AU, focusing particularly on role of the magnetic field. Shocks are known to be efficient accelerators of charged particles to high energies. Those driven by coronal mass ejections, for instance, produce the most intense events at the highest energies. The physics of particle acceleration is reasonably well understood, but is based largely on solutions to equations using simple local geometries. However, as shocks move from near the Sun to 1 AU, the magnetic field, through which they move, varies considerably. The magnetic field plays a critical role in determining the rate of particle acceleration, and hence, the maximum energy achievable. Spacecraft far from the Sun observe particle intensities and spectra that are a convolution of local processes that vary as the shock moves outward. PUNCH will provide powerful contextual information regarding the variation of CME-driven shocks, particularly the variation in the magnetic field strength and its morphology with respect to the shock front, that, when combined with in situ measurements from Parker Solar Probe and Solar Orbiter, and others in the Heliophysics System Observatory, and large-scale computer modeling, will allow for a more-complete understanding of the acceleration of high-energy particles.
Presentation file
giacalone-2021.pdf
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