Topic of the Talk: Introducing the Physics of Magnetic Reconnection in Space Plasmas

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Magnetic reconnection is a process where magnetic field lines "reconnect" into an alternate orientation, and this change in topology releases thermal and kinetic energy in the process. This process can abruptly convert energy stored in magnetic fields to energy in charged particles, and power diverse phenomena such as solar and stellar flares, magnetic storms and aurorae in near-Earth space, and major disruptions in magnetically confined fusion devices. It is behind many of the dangerous effects associated with space weather, including damage to satellites, endangering astronauts, and impacting the power grid pipelines. Understanding the physics of magnetic reconnection is therefore essential for explaining how magnetic energy is explosively released and for improving our ability to predict and mitigate the effects of space weather. Although the concept appears simple, reconnection involves a complex interplay of physical processes occurring over a vast range of spatial and temporal scales. Over large scales, plasmas are generally well described by the frozen-in behavior, in which magnetic field lines move together with the plasma. However, within much localized region of space, this ideal behavior breaks down because kinetic effects come into picture. This talk will provide an introduction to the physical principles governing magnetic reconnection, highlighting why a multiscale perspective is necessary for understanding such phenomena.