

Professor G. Lapenta

**Title:** Coupling solar inputs to the magnetosphere-ionosphere system down to the middle and lower atmospheres

**Abstract.**

We review the application of kinetic and fluid simulation techniques to the study of space weather events. We focus especially on the methods designed to overcome the difficulties created by the tremendous range of time and space scales present in the physical systems. We consider first the explicit formulation highlighting its severe limitations due to the presence of stability constraints. Next we introduce implicit methods designed to remove such constraints. We describe both fully implicit methods based on the use of non-linear iteration solvers and semi-implicit methods based on the linearization of the coupling and on simpler linear solvers. We focus the discussion on the implicit moment method and on the application of adaptive methods. Finally practical considerations about the implementation of implicit methods on massively parallel computers to conduct studies of space weather events are given.