

The Department of Physics and Astronomy
presents

2023 William H. Nelson Lecture:



AVALANCHES, EARTHQUAKES AND SOLAR FLARES

Prof. Paul Charbonneau, Université de Montréal,

Tuesday, 4 April 2023, 3:15pm, 25 Park Place, Room 223

(refreshments start at 2:30 pm)

Pre-Lecture Event: 25 Years of HyperPhysics (starts at 3:00 pm)

Abstract: Avalanches, earthquakes and solar flares; beside posing a threat to human societies and infrastructures, what could these three natural phenomena possibly have in common? They unfold on widely different spatial scales, from hundreds of meters for a snowslope, hundreds of kilometers for a seismic fault, up to tens of thousands kilometer for a solar active region. Moreover, their internal dynamics relies on very different physics: friction between snowflakes, elastic deformation or rock, and dissipation of electrical currents. One key commonality, however, is that all three are natural systems that accumulate energy very slowly, but release it in a strongly intermittent and scale-invariant manner.

In this talk I will discuss a physical modelling paradigm whereby such natural complex systems and phenomena emerge from a great many simple dynamical elements interacting locally with one another at scales much smaller than the global scale of the system. Complexity thus emerges from simplicity! In illustrating and explaining these ideas, the emphasis will be placed on solar flares, these being one of the major drivers of space weather.



Paul Charbonneau is professor of Physics at the Université de Montréal (Canada) since 2002. During the preceding decade he was a member of scientific staff of the National Center for Atmospheric Research's High Altitude Observatory, in Boulder (Colorado, U.S.A.). His research is primarily in the areas of computational physics and numerical simulations, focusing on magnetohydrodynamics, the dynamo mechanism underlying solar and stellar magnetic cycles, and the prediction of solar flares. He also pursues other research interests, notably in the emergence of complexity in natural systems, and more recently extending into related issues in the context of the origin of life. He has authored or co-authored over 150 research articles, review articles, and book chapters, and is the authors of two research monographs/textbooks entitled *Solar and Stellar Dynamos* (2013, Springer) and *Natural Complexity* (2017, Princeton University Press).

The William H. Nelson Physics & Astronomy Research Endowment was set up to honor the memory of Dr. William H. Nelson by the Nelson family. Dr. Nelson worked at GSU from 1974 until his sudden death in 2010.



Dr. Nelson began as an assistant professor in 1974, became tenured in 1981, a full professor in 1988, and served as the acting chair of Physics & Astronomy from 1992-1994. He became full chair in 1994. In 2004, Dr. Nelson became Associate Dean of Research and Graduate Studies for the College of Arts & Sciences. In 2009, he served as interim chair of the Math Department.