SEMINAR NOTICE

Department of Physics and Engineering Physics
University of Saskatchewan

SPEAKER: Dr. Igor Morozov
Department of Geological Sciences

TOPIC*:* ***Q?*** (on the Q-*factor for seismic attenuation)*

DATE: November 15th, 2016

TIME: 3:30-4:30 p.m.

PLACE: Physics 103

ABSTRACT:

In 1964, one of the most prominent American seismologists, Leon Knopoff, published his famous paper about seismic attenuation entitled “Q”. The brevity and symbolism of this title appears quite representative of our current understanding of this phenomenon. In this talk, I review some of the key observations and theories of seismic-wave attenuation within the Earth and tidal attenuation within planets.

Attenuation of seismic waves is usually characterized by the quality factor, or Q. In its original definition, this factor was expected to be a constant; however, in most modern applications, it is found to be dependent on the oscillation frequency. This dependence is explained by relaxation processes within materials and wave scattering and summarized as the “frequency-dependent Q” of the Earth’s medium. This dependence as well as the relation between the Qs for bulk and shear deformations are among the most fundamental seismological observations. However, by looking into the origins of Q in mechanics, and also into the ways it is measured in seismology, it appears that the Q may not be the best or even correct way for describing mechanical friction within the Earth.

A paradox of modern models of seismic and tidal attenuation is that it is still unclear whether the basic quantity on which they are based (the Q) really exists. I argue that in fact, not one but two types of Q are present in the models, and for each of these types, more adequate physical representations of attenuation can be found. The first type is the “apparent Q” that is more or less directly inferred from observations. In this case, returning to the underlying concept of attenuation coefficient often leads to significantly improved interpretations of the data. This point is illustrated by revisiting a broad range of published results. The second type of Q is the “viscoelastic Q”, which is usually assumed to be a material property. I also review several models for Earth materials and show that such Q is actually difficult to specify rigorously. Nevertheless, physically-consistent descriptions of mechanical friction by means of viscosity and material flows can be formulated instead of this Q.

Coffee and Cookies will be served in Physics 103 at 3:00 p.m. for those attending the seminar.