2nd Asia-Pacific Conference on Plasma Physics, 12-17,11.2018, Kanazawa, Japan

Waves and solar flare seismology from photosphere to corona

Alina Donea[1],
[1] School of Mathematics, Monash University
alina.donea@monash.edu

.

Solar flares produce seismic waves in the Sun's interior that resemble those created by earthquakes. The acoustic waves travel through the solar interior and return as sunquake photospheric waves or ripples. The acoustic nature of solar flare generated waves is now well established, with their sources identified using local helioseismic techniques such as time–distance analysis (Kosovichev and Zharkova 1998) and helioseismic holography (Donea et al. 1999, 2005). However, an interesting unexplained property of seismic waves is the highly anisotropic appearance, that accelerate radially outwards from the source region. The anisotropy is usually observed as a significant enhancement of the wave amplitude in one direction and it will be largely discussed in this work and Donea et al (2018). We will be focusing on the analysis of magnetic fields at the location of the seismic sources and where waves return to the surface. We consider that inclined magnetic field in sunspot penumbrae, where most of the seismic sources from flares were detected, might cause variations of measured acoustic travel times (or large phase shifts) as introduced by overlying surface magnetic fields (Schunker et al. 2005) and therefore influence our interpretations.

As ample observations of the quaked active regions above the photosphere are available, we will also use observations of the low-chromosphere plasma up to the corona to look for chromospheric and coronal responses related to solar flares. The search should elucidate what are the correct atmospheric conditions to ignite seismic sources, deep into the magnetised photosphere. We will also consider Alfvén waves pulses (Khomenko, Cally 2012) in coronal loops and look at the transport of wave energy downwards into the footpoints, as possible sources for seismic waves.

References:

Donea, Braun and Lindsey, ApJ, 513, L14 (1999)

Donea and Lindsey, Seismic Emission from the Solar Flares of 2003 October 28 and 29. ApJ, 630:1168–1183 (2005)

Donea, Pennicott, Cally and Lindsey, Solar Physics (under preparation, 2018)

Kosovichev and Zharkova 1998, Nature, 393 317–318

Khomenko and Cally, Numerical simulations of conversion to Alfvén waves in sunspots. ApJ. 746 , 68 (2012).

Schunker, Braun, Cally, LindseyAstrophys. J. Lett. 621 , L149 (2005)