**NOFEAR –** New Outlook on seismic faults: From EARthquake nucleation to arrest

With an average toll of 80.000 deaths per year over the last decade, earthquakes remain one of the most dreadful geohazards. The advancement of earthquake risk assessment and forecasting methods (probability estimates that a mainshock may occur in terms of hypocentre location, magnitude and time) calls for a sound physical basis. The nucleation, propagation and arrest of an earthquake rupture results from the interplay of stress perturbations, micro- to macro-scale friction- and rupture-related processes and fault zone geometrical complexity. Most of the information about these parameters is out of reach of seismic waves and geophysical analysis. Here we aim at enhancing our knowledge of earthquake physics (from nucleation to arrest) by means of a multidisciplinary approach that includes:
1) experiments to investigate earthquake nucleation by reproducing crustal (pressure, temperature, presence of fluids, stress perturbations, etc.) deformation conditions with the most powerful earthquake simulator installed worldwide (SHIVA);
2) experiments to investigate rupture propagation on simulated faults using natural rocks and small-scale analogue models;
3) field studies of exhumed seismogenic sources to quantify the geometrical complexity of natural fault zones;
4) advanced numerical simulation techniques that will integrate the above information and allow up-scaling to natural faults.
The numerical models will produce physically-based earthquake simulations that will be compared with high-resolution seismic data.
By reproducing crustal deformation conditions (stress, temperature, fluid pressures, etc.) in the laboratory and by monitoring acoustic emissions, gases, electromagnetic waves, etc., produced by the rock samples during deformation, a by-product of our research will be the systematic investigation of precursory phenomena (seismic, chemical, and electromagnetic) associated to earthquake nucleation processes.

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**Department:** Geosciences

**Coordinator:** Università degli Studi di Padova

**Total EU Contribution:** Euro 1,963,800

**Call ID:** ERC-2013-CoG

**Project Duration in months:** 66

**Start Date:** 01/07/2014

**End Date:** 01/01/2020

**Find out more:** https://cordis.europa.eu/project/id/614705