1. **Research activity (max 1.000 words)**

With this proposal I will develop numerical models for earthquake dynamics building on the research activities that the geophysical research group in Sapienza has been carrying out with ENI, on a CO2 test-site in the Adriatic area. In particular these activities will provide me with the geometry of the major faults within the reservoir, the thickness of the sealing horizon together with the frictional properties of all the fault rocks.
I will use Q-Dyn, a software open source (Luo et al 2017) - that I already got familiar with during the master thesis - to model many dynamic ruptures (seismic cycles) on a fault line (1D) and then on a fault plane (2D). Following the work done for the thesis, implement new python scripts in order to manage Q-Dyn's output and to interpret the results. Compare the friction response between different constitutive laws, in particular the rate- and state- laws, even in their modified form, and the Chen-Nijmeijer-Spiers law (Chen et al. 2017). I will also use SeisSol (Dumbser et al. 2006), a software package for simulating wave propagation and dynamic rupture generated by a finite earthquake source (single event) governed by rate and state friction laws. Through this software it is possible to model also geometrically complex faults and heterogeneous velocity structures.
I will investigate with synthetic tests how the heterogeneous input parameters (e.g., friction parameters) and the boundary conditions (e.g, plate loading or fluid pressure loading) on the fault (1D, 2D) influence the nucleation and the rupture propagation during many seismic cycles. Following the work started during the master thesis, study the dynamic rupture variability due to the assumed fault asperites, normal stress, fault geometry and kinematic.
Eventually I will study three different cases that could provide new insights on the behavior of the dynamic rupture:

- I will model rupture nucleation and possible propagation from a reservoir-hosted fault into the sealing horizon, as a function of different values of CO2 fluid overpressure and different thickness of the seal (Cappa and Rutqvist, 2011).

- I will model the seismic cycles that may happen on thrust faults in the Emilia Romagna area, in order to study the long-term mechanical segmentation of the fault caused by lithological heterogeneities across such faults (Tesei et al 2014).

- I will model fault interaction using, as a case-study, the fault system that hosted the three largest seismic sequences in central Italy (Colfiorito 1997, L'aquila 2009 and Amatrice-Visso-Norcia 2016-2017).

2. **Research products**

    a) Publications (ISI journals)

    b) Publications (NON ISI journals)
    c) Manuscripts (submitted, in press)

    d) Abstracts