Magnetic hyperthermia is a non-invasive synergistic modality, currently used as a supplementary cancer therapy scheme in combination with standard chemotherapy or irradiation treatments. Up to date, its role is supplementary since it produces selective fatigue to cancer cells, thus may facilitate the success of combinatory schemes and lead eventually cancer cells to death. Magnetic hyperthermia is based on the ability of magnetic nanoparticles to produce variable amount of heat upon exposure on magnetic field depending on their magnetic features. The heating efficiency of magnetic nanoparticles is dependent on three major factors.

First, is the particle meaning the structural, morphological and magnetic features of the nanoparticles that play a key role together with the proper material’s choice. Second, are the solution parameters, which are the colloidal stability, homogeneity and viscosity of nanoparticle dispersion also, affecting significantly the macroscopic heating efficiency. Third, is the field characteristics, i.e. amplitude and frequency which in conjunction with the saturation magnetization, coercivity (and the anisotropy field) of the nanoparticles may lead to full or partial exploitation of the heat amount particles may deliver.

Under this aspect, in this bachelor thesis, we attempt to manipulate the dipolar interaction intensity and check its effect initially on magnetic features and eventually on heating efficiency. Thus, line arrays of magnetite nanoparticles (Fe$_3$O$_4$) are formed in varying agar content solutions. Agar, is incorporated in nanoparticles’ dispersion as a matrix to facilitate and freeze the particles linear chain formation during and after application of an external magnetic field (30-40 mT). In all cases, magnetite nanoparticles concentration was 4 mg/mL while agar content varied between 0.05-10 mg/mL. For each agar content solution, three different samples were prepared: a). the reference sample where nanoparticles are left to form arbitrary arrangements in the absence of magnetic field and b), c) where samples driven by the static magnetic field tend to form chains either parallel (at 0°, //) or perpendicular (at 90°, ⊥) to the applied field. Scanning Electron Microscopy imaging provides the illustration of the success of chain formation for specific agar content and field intensity. For all samples, the heating efficiency was checked with magnetic hyperthermia using two AC magnetic fields of 210 and 765kHz with constant amplitude of $H_{AC}=30$mT. Our results denote that the parallel arrangement of particles favors the heating efficiency when compared with perpendicular and reference samples. This is correlated with the magnetic features of the particles themselves, colloidal viscosity and the field parameters. Consequently, the array formation of magnetic nanoparticles provides an additional degree of freedom in manipulation of magnetic hyperthermia mediators via the dipolar interaction refinement and unravels the strong connection of macroscopic heating efficiency with the microscopic structural and magnetic features.