**Millimeter Wave Radiation and Biological Health effects on Humans**

**PIs**: Profs. Ted Rappaport, Dan Sodickson, Chris Collins

**Students:** Ting Wu (Ph.D. student in ECE), Leeor Alon (Med School PhD, soon to be Post-Doc)

**Introduction of Team:** Ting is a top new Ph.D. student at Poly, and a Provost’s fellowship winner, focusing on biological effects for her Ph.D. Leeor is graduating from the MRI program with a Ph.D. and will soon be be a post-doc with Drs. Sodickson and Collins. Leeor is co-founder of RF TestLabs, a company using MRI to measure emag radiation in the body).

**Affiliate Sponsors with direct interest**: All of them (per board meeting)

**Overview Research Statement**: This project allows NYU WIRELESS students and faculty to develop new mmWave radiation guidelines based on measurement, analysis, and Emag simulation used in MRI. Working with affiliate board members such as Intel, we will conduct EMAG simulations on thermal heating due to exposure of mmWave, and will measure actual heating on flesh samples using NYU WIRELESS mmWave equipment and the MRI capabilities for measuring temperature gradients. The project will involve simulation, analysis, and measurement, and will involve Industrial Affiliates to create new mmWave exposure standards.

**Research Thrusts and Improvements for NYU WIRELESS**: Ting Wu and Rappaport have already been discussing global Electromagnetic regulations with Intel, and have submitted the world’s first survey paper on the topic. Intel has told us that the FCC is about to abandon Rule OET-65c for Emag, radiation tests. The time is ripe for new regulations that are based in careful measurement, simulation, and analysis. Prof. Collins at the NYU Med School is a leader in electromagnetic radiation and biological effects, and has offered his extensive electromagnetic simulators based on FDTD methods. Dr. Sodickson has committed time on the MRI machines at NYU Med School to evaluate the heating of samples after radiation exposure. Our project will first summarize all of the global work on mmWave characterization, and will identify the weaknesses or areas of uncertainty with today’s rules (for example, SAR appears to be a poor way to characterize electromagnetic exposure at mmWaves). After the careful literature study, we shall work together to form a series of simulations, experiments, and theoretical analyses that enable us to provide better models, demonstrated by both measurement and theory, all to be conducted in the coming year, in time for preliminary results at the April 2015 board meeting. This is a breakthrough leadership opportunity, where NYU can lead industry to important answers in this topic, and sets us up as leader/convener.

**Existing support and additional justification for the Project**: Ting Wu is funded by a Provost Fellowship, and she has been in the top ¼ of all of her classes at Poly. She came with 5 years of experience in the semiconductor industry, and is reliable/competent in speaking with industry, and working across boundaries. Leeor Alon is an expert in using MRI measurements and emag simulation to predict heating on the surface and in the body, and will remain supported as a Post Doc at the Med School. Thus, substantial funding has already been provided and they are showing strong results from it.

**Justification for this project :** Publications and useful results for industry are clearly two results that will evolve from this project, but the most important impact will be the ability to educate and dialogue with the engineers at our affiliate companies, to help them (and learn from them) as we create new guidelines for safe exposure levels. This will help NYU WIRELESS become a global leader in the move to mmWave devices, and will bond the Med School and Engineering students and faculty closer together on a meaningful project. This will also help get important collaboration going between the Med School (MRI) and wireless faculty, with Ting Wu and Leeor Alon being the conduits for the collaboration. Ting has demonstrated a very keen interest and desire to be an expert in this field, as evidenced by her solid tutorial on radiation effects that was recently submitted to Globecom 2014.