



15th European Doctoral School on Metamaterials Fundamentals of Metamaterials Electromagnetics

Levi, Finland, November 16-20, 2009

Program:

Monday 16

Hour	Topic	Lecturer
08:00 - 08:15	Registration	
08:15 - 08:30	Opening remarks	
08:30 - 11:30	Basics: Maxwell equations, constitutive relations, Wave equations, plane waves, wave numbers, Complex material responses Anisotropy: Chirality and non-reciprocity, Bianisotropy Dispersion: Constitutive relations in time domain, Causality and Kramers– Kronig conditions Basic dispersion models: Lorentz model, Drude model, Debye model	A. Shivola
11:30 - 12:30	Lunch	
12:30 - 16:00	Free time and self-study	
16:00 - 19:00	Split rings: Response of rings, Circuit model, Lorentz behaviour Wire media: Electromagnetic properties of wire lattices, Circuit model, Drude behavior, Spatial dispersion in wire media	S. Tretyakov

Tuesday 17

Hour	Topic	Lecturer
08:00 - 11:30	Effective medium modeling: Polarizability and single-particle response, Maxwell Garnett homogenization, Bruggeman homogenization Workshop (student presentations)	A. Shivola
11:30 - 12:30	Lunch	
12:30 - 16:00	Free time and self-study	
16:00 - 17:30	DNG metamaterials: Negative parameters, Physical limitations, Plane waves in DNG media, Negative refraction, surface–wave resonance	S. Tretyakov
18:00	Social event – Lappish dinner	

Wednesday 18

Hour	Topic	Lecturer
08:00 - 11:30	Small inclusions for metamaterial design: Fundamentals of split ring resonator design, Miniaturization of split-ring-based inclusions, Limitation of the split-ring resonator at higher frequencies - alternative designs Workshop (student presentations)	F. Bilotti



11:30 - 12:30	Lunch	
12:30 - 16:00	Free time and self-study	
16:00 - 19:00	Enhanced transmission through sub-wavelength apertures and fundamentals of cloaking devices, Enhanced transmission through sub-wavelength apertures using miniaturized split-ring-based inclusions, Fundamentals of cloaking devices, Applications of enhanced transmission and cloaking devices Self-study	F. Bilotti

Thursday 19

Hour	Topic	Lecturer
08:00 - 11:30	Plasmonic resonance and plasmonic media, Fundamentals of optical properties of metals, Plasmonic resonance of small particles, Plasmonic materials Surface plasmon polaritons, Fundamentals of surface waves on interfaces, Surface plasmon polaritons on metal surfaces, Excitation and propagation of surface plasmons	N. Engheta
11:30 - 12:30	Lunch	
12:30 - 16:00	Free time and self-study	
16:00 - 19:00	Analogies between microwave circuits and arrangements of plasmonic nanoparticles, Fundamentals of plasmonic nanoparticles as resonators, Optical capacitors and inductors, Epsilon-near-zero and mu-near-zero materials, Large values of material parameters, Optical conductors and isolators Self-study	N. Engheta

Friday 20

Hour	Topic	Lecturer
08:00 - 10:00	Optical nanocircuits, Optical filters, "Squeezing" electromagnetic fields through small openings, Optical transmission lines, Overview of "metactronics"	N. Engheta
10:00 - 11:30	Self-study	
11:30 - 12:30	Lunch	
12:30 - 16:00	Closing workshop (students presentations)	