

Research Fields and Facilities

The Department of Physics faculty is currently involved in research in three broad areas: biophysics and medical physics, condensed matter physics: theory and experiment, and gravitational theory. Specifically, the biophysics and medical physics group has been studying the mechanisms underlying bioelectromagnetic interactions as well as the biomedical topics of biomagnetism; the biophysics and biomechanics of osteoarthritis, stroke cerebrovascular disease, brain tumor, and hyperthermia; neuromagnetic studies of neurological disorders such as epilepsy, Parkinson's disease and migraine headache; NMR imaging, NMR microscopy and *in vivo* NMR spectroscopy cardiac electrophysiology; and photodynamic therapy. The condensed matter physics group has been studying thin film magnetism, surface physics, magnetic properties of materials, silicon and germanium crystal growth, phenomena associated with phase transitions and chaos, and the optical properties of solids under high pressure. The gravitational theory group has been studying gravitational collapse, the formation of singularities, black holes and cosmology.

Research facilities in the high pressure optics laboratory include spectrometers and single and multi-channel detectors for Raman and luminescence studies in the visible and near infrared regions. Additional equipment includes an argon ion and a Ti:Sapphire laser, closed cycle helium refrigerator, and high pressure cells for generation of pressures up to 10 GPa (~10,000 atm). Research facilities in the condensed matter physics laboratories include a Faraday magnetometer, an AC susceptometer, a ferromagnetic resonance spectrometer at x-band, a Philips x-ray diffractometer, one and two kilowatt RF power supplies with 50- Ω matching networks for silicon ribbon growth, and vacuum facilities for thin film evaporation and fullerene preparation. Biomagnetic research facilities include the Kettering Magnetic Laboratory that provides a non-magnetic environment. Research facilities in the NMR microscopy laboratory include a Bruker AMX 300 NMR spectrometer with a 7-Tesla / 89-mm vertical bore superconducting magnet and micro-imaging accessories.

Among research facilities in neighboring hospitals available to medical physics students and faculty are a 3.0-Tesla whole-body NMR system and a 7.0-Tesla / 20-cm horizontal bore magnet NMR system for imaging and *in vivo* spectroscopy, a megawatt-pulsed tunable dye laser and argon ion laser for photodynamic therapy research, a 148-channel whole head SQUID neuromagnetometer, a nuclear medicine laboratory, radiology and CT scanning facilities, an advanced modalities cancer therapy laboratory including radiotherapy and hyperthermia, diagnostic ultrasonic equipment, a laser surgery laboratory and two major hospital medical libraries.

"The faculty of the Department of Physics encouraged me to pursue the Ph.D. in Biomedical Physics... I only wish I could attract a few of their recent graduates, particularly those with MR expertise, toward New York, because the need is still growing!"

Craig Branch
(Ph.D. 1989)

"The Department of Physics provided a high quality education and much personal attention from the faculty."

Tim Stanton
(B.S. 1974)

"The personalized help and support that I received from the Department of Physics during my Oakland University experience was the most important factor in my success in the program. The education that I received from Oakland University provided me with well rounded and solid background that has helped me throughout my career. In fact, one of the key reasons that I was selected as VP of Finance at Altair Engineering was my background in Physics and my ability to understand Altair's overall business as compared with someone with a pure finance background."

Tom Perring
(M.S. 1971)