This Spring ('24) the UMD Math Department offers the graduate course

MATH858G: Asymptotic Methods with Applications

TuTh *9:30-10:45am,* Rm. *MTH 0307*
(subject to change)

Instructor: Dio Margetis (***diom@umd.edu***, 5-5455)

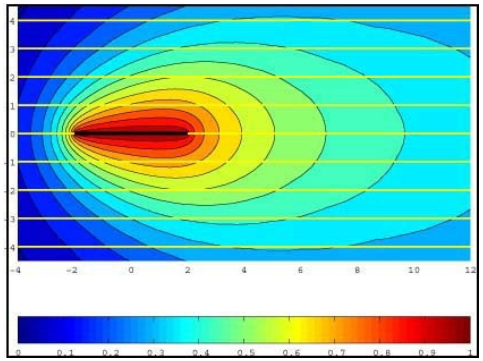

FIG. 1: Temperature around a plate (red: hot, to blue: cold). This can be obtained analytically by approximately solving an advection-diffusion eqn.

THEME: Mathematical concepts and tools for **asymptotics and perturbation theory** used in models of scientific disciplines. Applications are from atomic & condensed matter physics, fluid and solid mechanics, materials science, quantum mechanics.

TOPICS: Convergent, asymptotic & formal series expansions.

Perturbation methods for ODEs, PDEs & discretized (difference) eqs.

Regular & singular perturbations; boundary layer theory. Multiple scales.

WKB & related methods. Homogenization methods. Bifurcation & stability.

Applications: Nonlinear waves in fluid and gas dynamics; nonlinear diffusions in solid materials; scattering in electromagnetics & quantum mechanics; porous media; homogenization of composites; cloaking.

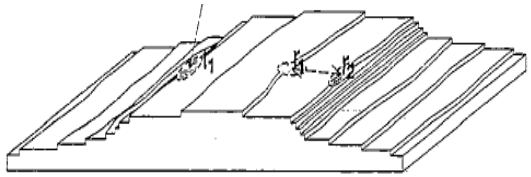

FIG. 2: Line defects on crystal surfaces. The description of their motion can be simplified via asymptotics to system of ODE's.
(Image: Jeong & Williams, **Surf.Sci. Rep**. 1999)

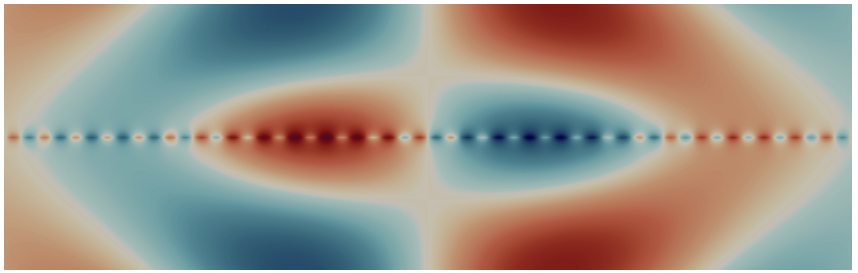

FIG. 3: Fine-scale electromagnetic wave (surface plasmon) on graphene. This can be described by two-scale analysis for particular solutions of Maxwell's equations (Image: M. Maier, U.Texas A&M).