



This Spring ('26) the **UMD Math Department** offers the graduate course **MATH858V: Asymptotic Methods with Applications**

TuTh 9:30-10:45am, Rm. MTH B0431
(subject to change)

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

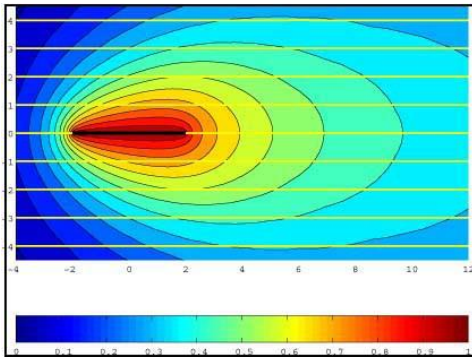


FIG. 1: Temperature around a plate (red: hot, to blue: cold). This can be obtained analytically by approximately solving an advection-diffusion eqn.

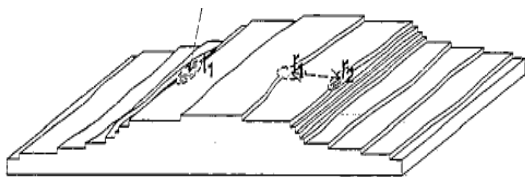


FIG. 2: Line defects on crystal surfaces. The description of their motion can be simplified via asymptotics to system of ODE's.

(Image: Jeong & Williams, *Surf.Sci. Rep.* 1999)

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.

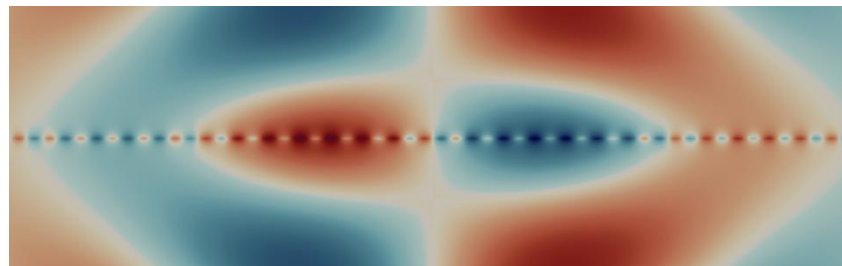


FIG. 3: Fine-scale electromagnetic wave (surface plasmon) on graphene. This can be described by two-scale analysis for particular solutions of Maxwell's equations (Image: M. Maier, U.Texas A&M).