DIFFERENTIAL GEOMETRY/PDE SEMINAR

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Mathematics of photonic crystals

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The burgeoning young area of research on photonic crystals can be considered as a dream of an applied mathematician: it is of paramount practical importance, many its problems are precisely formulated in exact mathematical terms and unresolved, and resolving them requires a wide range of mathematical tools ranging from algebraic geometry to several complex variables, to partial differential equations, to probability theory, to numerics. A photonic crystal is an artificial periodic dielectric medium that is an optical analog of semiconductors. Its main property is existence of a "complete band gap", i.e. of an interval of frequencies for which electromagnetic waves cannot propagate in the medium. Creation of such a material promises to bring about revolutionary changes in technology. The talk will provide a brief overview of the mathematical component of the problem of creating photonic crystals. The major part of deals with different aspects of spectral theory of differential and pseudodifferential operators (Maxwell operator, some its scalar counterparts, Dirichlet-to-Neumann operators on graphs, ODEs on graphs, etc.).