The Born-Infeld equation: solutions and equilibrium measures

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In this talk, we deal with the following problem

$$\begin{cases} -\operatorname{div}\left(\dfrac{\nabla\phi}{\sqrt{1-|\nabla\phi|^2}}\right) = \rho, \quad x \in \mathbb{R}^N, \\ \lim\limits_{|x|\to\infty} \phi(x) = 0. \end{cases} \tag{$\mathcal{BI}$}$$

The equation in ($\mathcal{BI}$) appears for instance in the Born-Infeld nonlinear electromagnetic theory: in the electrostatic case it corresponds to the Gauss law in the classical Maxwell theory and so ϕ is the electric potential and ρ is an assigned extended charge density.

In the first part of the talk, we discuss existence, uniqueness and regularity of the solution of ($\mathcal{BI}$). In the second part, instead, we deal with existence of *equilibrium measures* ρ^*, namely distributions that produce least-energy potentials among all the possible charge distributions, and properties of the corresponding *equilibrium potentials* ϕ_{ρ^*} for ($\mathcal{BI}$).

The results have been obtained in joint works with Denis Bonheure (Université libre de Bruxelles, Belgium), Pietro d'Avenia (Politecnico di Bari, Italy) and Wolfgang Reichel (Karlsruher Institut für Technologie, Germany).