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**The supercritical mean field equation on closed surfaces**

In this talk we report on the mean field equation

$$-\Delta_g u + \varrho = \varrho \frac{he^u}{\int_{\Sigma} he^u dV_g}$$

on a closed Riemannian surface  $(\Sigma, g)$  with unit volume, where  $h$  is a smooth positive function defined on  $\Sigma$ ,  $\Delta_g$  is the Laplace-Beltrami operator of  $(\Sigma, g)$ ,  $dV_g$  its volume form, and  $\varrho$  is a positive integer multiple of  $8\pi$ . When  $\varrho \in 8\pi(\mathbf{N}^* \setminus \{1\})$ , the associated Euler-Lagrange functional is neither bounded from below nor from above. Furthermore, if  $\varrho \in 8\pi\mathbf{N}^*$ , then the problem becomes noncompact in the sense that “critical points at infinity can occur”. Using a refined analysis of blowing up solutions to some perturbations of the mean field equation, we give a precise characterization of the possible loss of compactness associated with a new algebraic-topological argument we solve the problem in many open cases.