The space of Hardy weights for quasilinear equations: Maz'ya-type characterization and sufficient conditions for existence of minimizers.

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30/05/2023, ore 10.00

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Abstract: Let $p \in (1,\infty)$ and $\Omega \in \mathbb{R}^N$ be a domain. Let $A := (a_{ij}) \in L^\infty_{loc}(\Omega; \mathbb{R}^{2N})$ be a symmetric and locally uniformly positive definite matrix. Set $|\xi|_A^2 = \sum_{i,j=1}^{N} (a_{ij})\xi_i\xi_j, \xi \in \mathbb{R}^N$, and V be a a real valued potential in a certain local Morrey space. We assume that the energy functional.
$Q_{p,V,A}(\phi) = \int_\Omega (|\nabla\phi|_A^2 + V|\phi|^p)dx$ is nonnegative on $W^{1,p}(\Omega) \cap C_c(\Omega)$. We introduce a generalized notion of $Q_{p,V,A}$ -capacity and characterize the space of all Hardy-weights for the functional $Q_{p,V,A}$, extending Maz'ya's well known characterization of the space of Hardy-weights for the *p*-Laplacian. In addition, we provide various sufficient conditions on the potential *V* and the Hardy-weight *g* such that the best constant of the corresponding variational problem is attained in an appropriate Beppo Levi space. Joint work with Ujjal Das.