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## Wall-crossing in N=2 theories: Smooth Index and Generalized Theta Series

I'll present the construction of an index in 4d N=2 supersymmetric gauge theories which is smooth across walls of marginal stability and appears as a natural generalization of the CFIV index in two-dimensional theories. I'll explain its physical and geometric interpretation originating in the hyperkahler structure of the 3d theory obtained by compactification on a circle. In the end, I'll also briefly discuss the behavior under wall-crossing of certain generalized theta series which appear, in particular, in the description of NS5-brane instantons in Calabi-Yau compactifications of type II strings.