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### **Sobolev Spaces on Metric Measure Spaces**

It is well known that the Sobolev spaces play an important role in analysis on metric measure spaces. In this talk, we present some characterizations of Hajlasz-Sobolev spaces on metric measure spaces via grand Littlewood-Paley functions and also the pointwise characterization of Besov spaces, Triebel-Lizorkin spaces, Newton-Besov and Newton-Triebel-Lizorkin spaces on metric measure spaces. As an application, we also show that quasiconformal mappings preserve some Triebel-Lizorkin spaces on metric measure spaces.