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Cocycles associated to values of derivatives of L-functions and their geometry.

Let f be a cusp form of even weight k for $\Gamma_0(N)$ and let $L_f(s)$ denote its L -function. We study critical values of derivatives of $L_f(s)$ by attaching to them certain cocycles with properties analogous to those of the modular symbol. This construction has a natural geometric interpretation in terms of the cohomology of the locally constant vector bundle associated to the relevant representation. We describe this interpretation in an explicit manner. As an application, an expression for cohomology classes of our cocycles (and thus values of $L'_f(s)$) in terms of linear combinations of periods is given. (Received September 24, 2000)