

## Complex Spin Pattern at the Fermi Surface of a Strongly Spin-Orbit Coupled Atom Layer

*Thursday, 19 September 2013 10:00 (30 minutes)*

The spin texture of the metallic two-dimensional electron system formed by Au on Ge(111) is revealed by fully three-dimensional spin-resolved photoemission, as well as by density functional calculations. The large hexagonal Fermi surface, generated by the Au atoms, shows a significant splitting due to spin-orbit interactions. The planar components of the spin exhibit a helical character, accompanied by a strong out-of-plane spin component with alternating signs along the six Fermi surface sections. Moreover, in-plane spin rotations toward a radial direction are observed close to the hexagon corners. Such a threefold symmetric spin pattern is not described by the conventional Rashba model. Instead, it reveals an interplay with Dresselhaus-like spin-orbit effects as a result of the crystalline anisotropies.

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**Session Classification:** Strongly Correlated Electron Systems: Novel Interaction Phenomena