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Surprising Evasions of Elliptic Obstructions

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In 1968, I met an elliptic integral when studying the decay of the eta meson. Then it was a surprise to find that elliptic integrals are not needed for the magnetic moment of the electron at two loops. In 1998, I expected elliptic obstructions when evaluating three-loop massive vacuum diagrams. Yet empirical fits to numerical integrations gave results in terms of polylogarithms. Recently I have found more examples, where integrals of elliptic integrals multiplied by polylogarithms are empirically reducible to classical tetralogarithms. I shall describe how Steven Charlton and I have proved these results. The basic idea is to arrive at a double integral of dilogarithms and then remove an obstructing square root of a quartic polynomial by a pair of Euler transformations.

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